SINGER
IN
WORLD WAR II

1939-1945

THE SINGER MANUFACTURING COMPANY Ltd.

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SINGER
IN
WORLD WAR II

CANCELLED

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1939–1945

THE SINGER MANUFACTURING COMPANY Ltd.
Clydebank, Scotland

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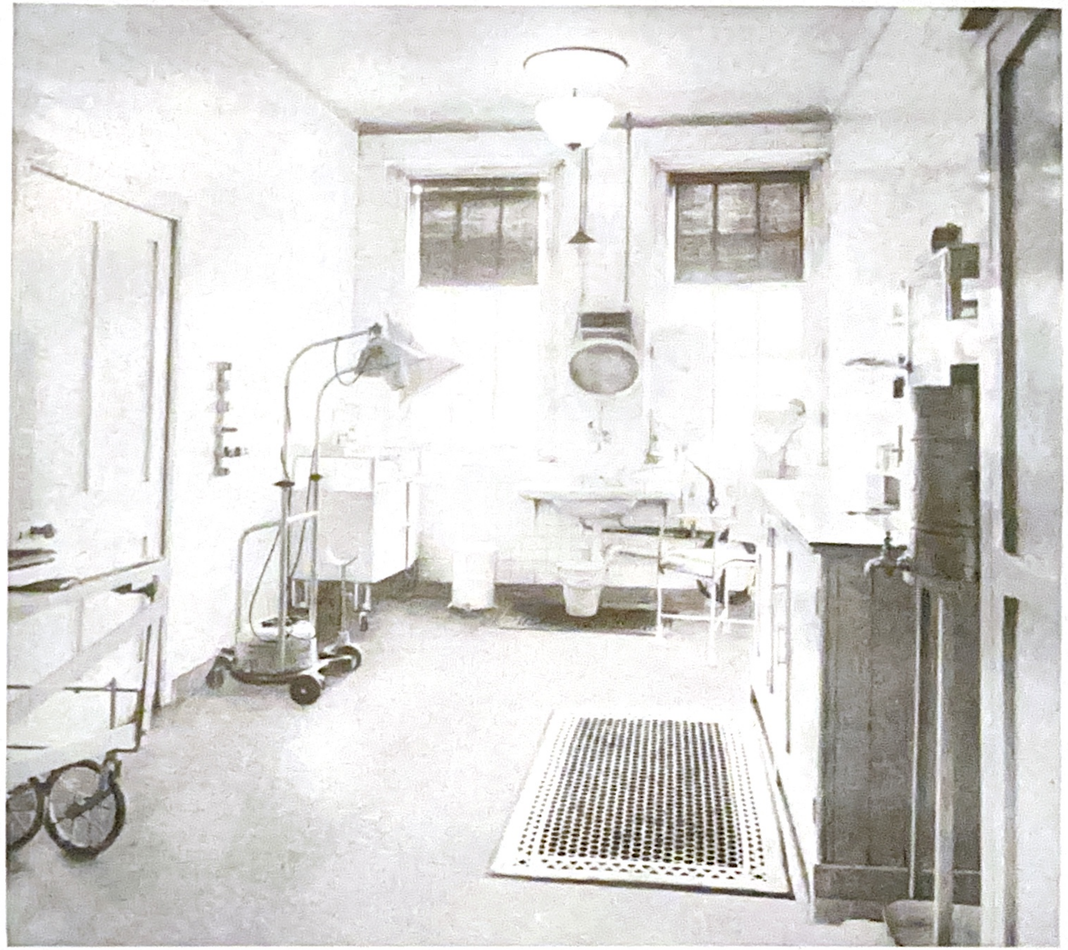
FOREWORD

THE story unfolded in the following pages tells briefly how The Singer Manufacturing Company, Ltd., of Clydebank, Scotland, placed its vast resources and skill at the service of the Country during the World War II, and thus assisted in the National effort towards final victory.

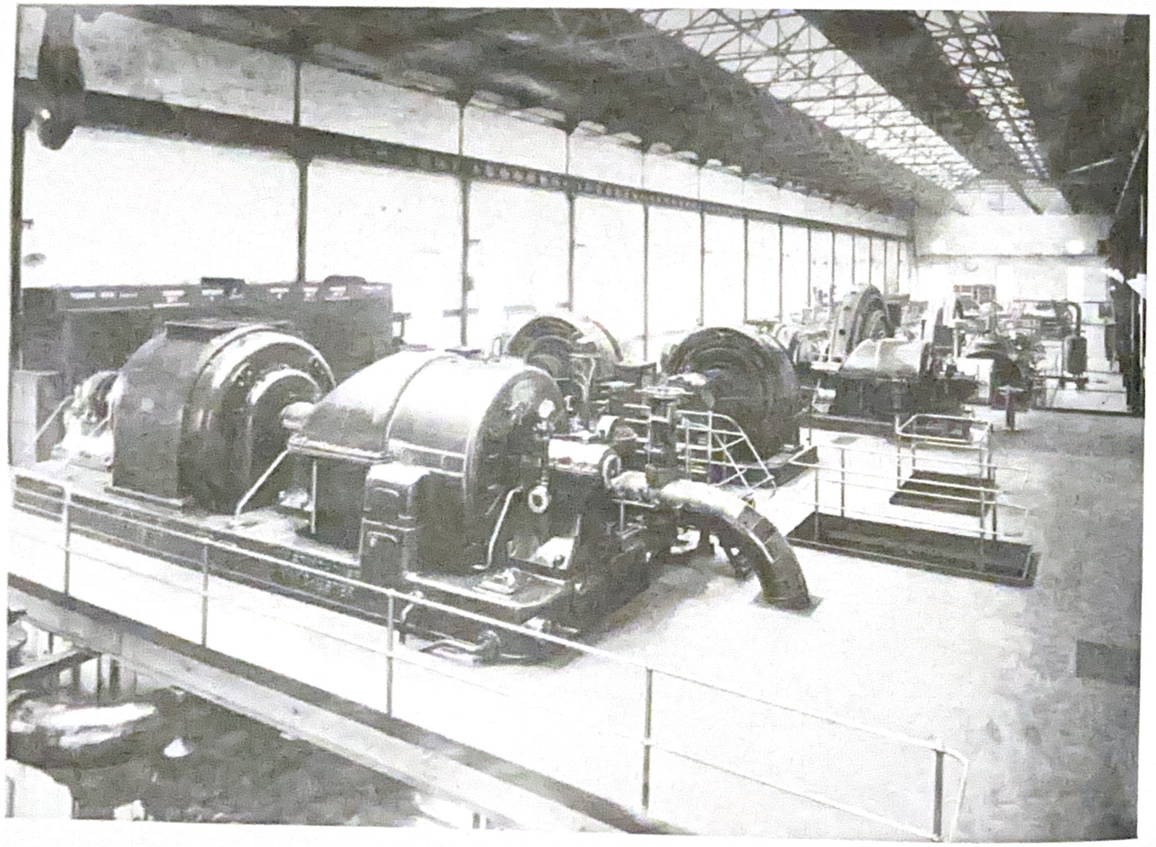
To the 1046 members of the Company's personnel who served in H.M. Forces on Land, Sea and in the Air, and to all those who by their unremitting toil in the Factory helped to sustain them by providing the "Tools to finish the job" these pages are humbly dedicated.

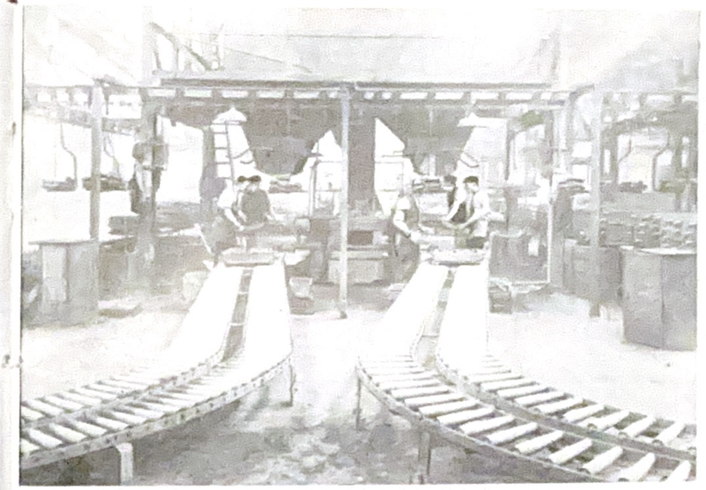


A view of the surgery in the Main Ambulance Station. There are also 28 departmental ambulance stations, each with a first-aid room and a recovery room and two trained ambulance attendants in charge.

During the war over 136,000 attendances were recorded.

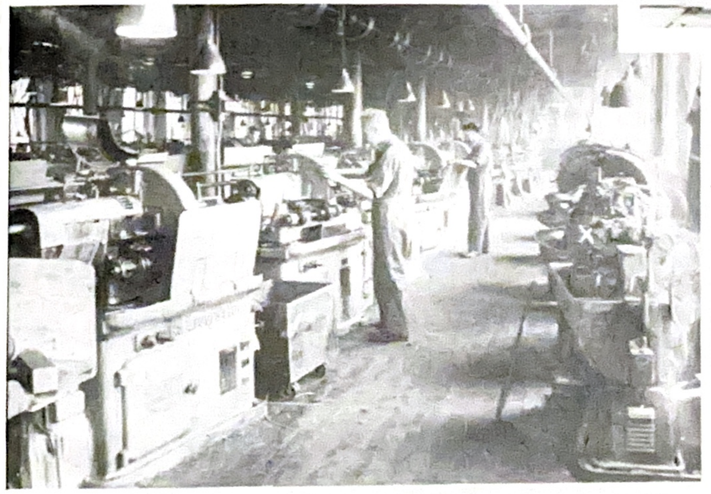
The illustration shows a view of the Power Plant. Aggregate 12,000 H.P. of electrical machinery, besides hydraulic pumps and other apparatus.





◄ FOUNDRY

WOODWORKING DEPARTMENT ►



◄AUTOMATIC SCREW DEPARTMENT

SEWING-IN DEPARTMENT ►

This book refers to the output of munitions and to the part played by the industrial sewing machine in providing equipment of every conceivable kind for the forces. It also deals with the manufacture of needles and parts required to service the many varieties of industrial sewing machines which were in constant use.

To ensure that every item of the Company's potential should be taken advantage of, constant visits were paid by its representatives to all the Supply Ministries. More and more of the Factory was converted from normal production to war contracts, and in some cases whole Departments were cleared and re-equipped.

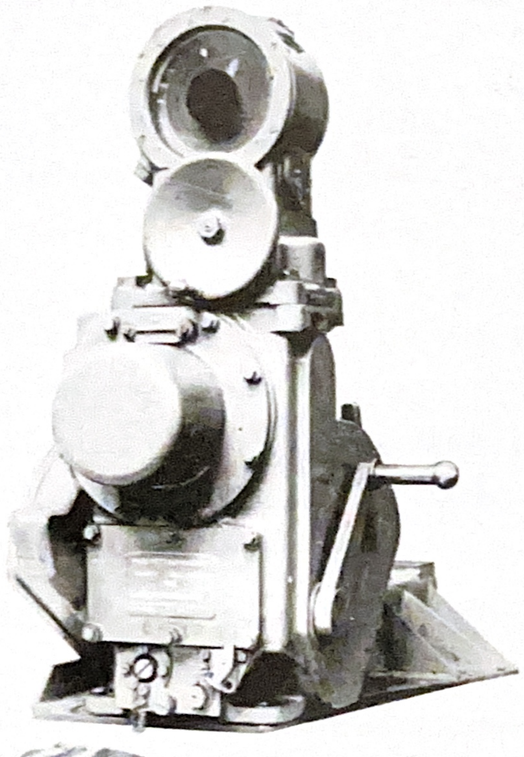
THE FIRST CONTRACT

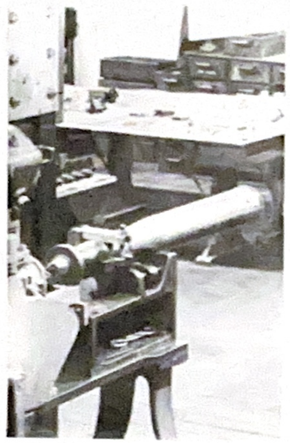
In September 1938, just one year before the outbreak of hostilities, the main Tool Making Department was entrusted with its first War Contract for a neighbouring Clydeside Aircraft Factory. The Contract comprised the provision of a complete set of Aircraft Wing Assembly Jigs, as well as a considerable amount of the initial tooling required to enable that Factory to get into production. Similar work was undertaken in the ensuing months of that year for other Aircraft Manufacturers all over Britain.

FUZE SETTING & RECEIVING MACHINES

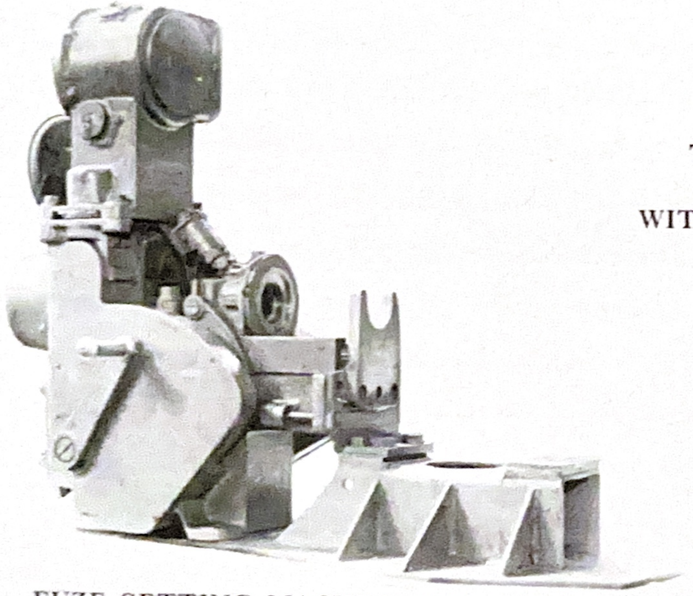
What might in less strenuous days have been considered full loading was however not sufficient when the urgent need was for tools, and still more tools, for the essential expansion in the production of war equipment. Thus in May 1939, after a visit to the British Admiralty, the Company embarked on the first direct Government contract for the complete production of Fuze Setting and Fuze Receiving Machines, a contract which continued uninterruptedly during the whole of the war period.

This apparatus, mounted in the Gun Turret in convenient and close proximity to the breech of the gun, enabled the fuze of the Naval shells to be set with extreme rapidity to the precise range of fire being ascertained in the Ship's Fire Control with which the Fuze Receiver was electrically connected.





TESTING FIXTURE
FOR SETTING
WITH FUZE IN POSITION



FUZE SETTING MACHINE WITH RECEIVER

Because of the rigidity and accuracy required by the specification and the nature and size of the components in the mechanism, it was decided to entrust this work to the main Tool Room, with the result that the Singer Fuze Setters earned very high commendation from the Admiralty for the uniform excellence of their performance.

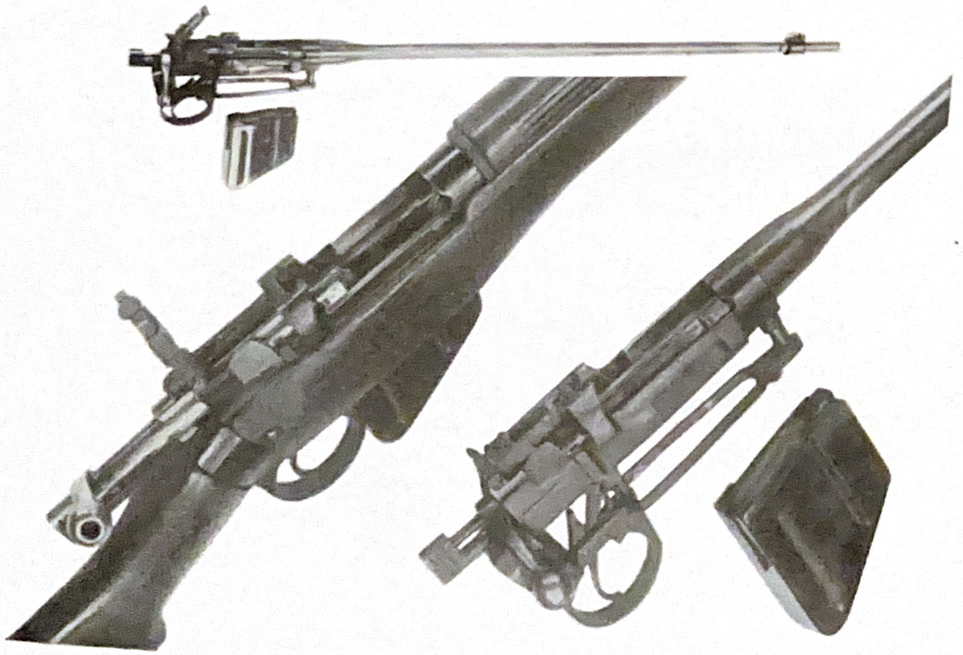
Into the preliminary tool making on the Jigs and Special Fixtures required for the production of Fuze Setters, went all the care and skill which the Toolmakers had acquired over the years and which was now to stand them in such good stead not only in this but in a multitude of equally difficult problems following in almost bewildering succession.

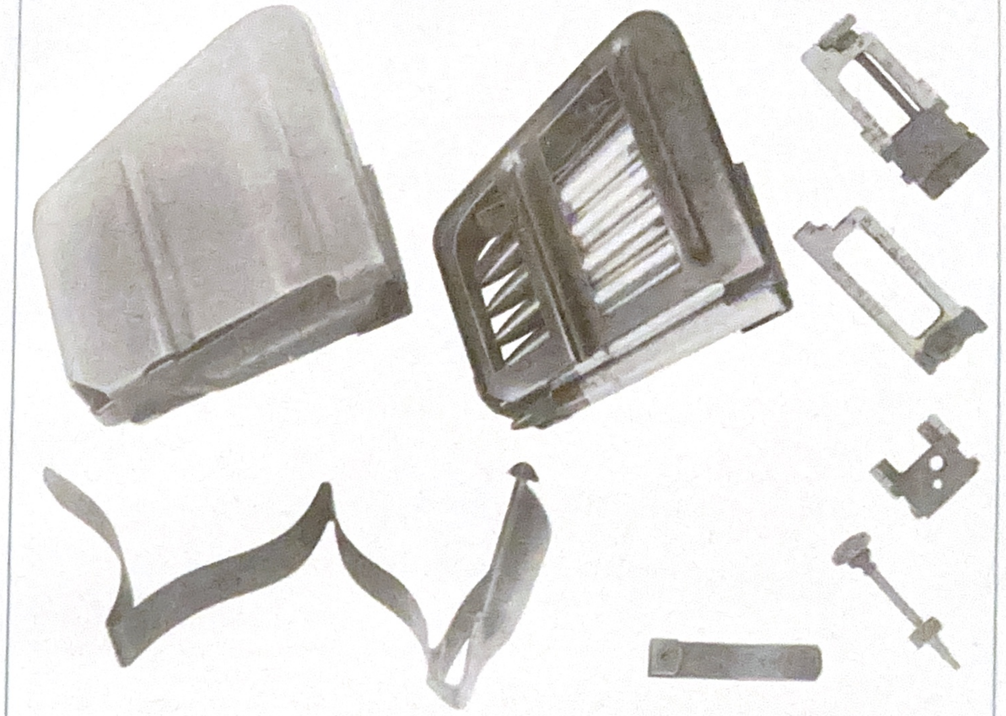
The Patterns were completed, the special Phosphor Bronze castings, gears, cams and shafts made their appearance on the machines, the fitters' bench became the focal point for all these parts and ultimately, finished in its coat of battleship grey, the first of the Fuze Setters was handed over to the Admiralty representative to prove its fitness for its destined job. The prototype came through with credit and was succeeded by a steady flow until August 1945, when more than 500 had been completed.

RIFLE COMPONENTS—MARKS IV. & V.

The capacity of the Company to produce great quantities of small intricate parts of high precision made it inevitable that a very important share of the small arms manufacture would come to the factory, and thus, Departments found themselves engaged in the manufacture of a variety of the most intricate parts of the Marks IV. and V. Rifle, including the Mark IV. Bayonet.

Urgent and heavy calls were made on the Design Staff and Tool and Gauge Rooms to make the necessary special jigs, fixtures, cutters and gauges and to convert existing machine tools for their new duties.





MAGAZINE AND BACK SIGHT

Operators were rapidly trained in the new technique and soon vast quantities of Rifle Components were being delivered to the Government Resident Small Arms staff of Inspectors for their seal of approval.

Production continued night and day from March 1941 to April 1947 and these parts left the Factory with unfailing regularity for the various Royal Ordnance Assembly Plants, so that when activities were suspended rather more than 60 million parts had been supplied, which, at production peak, represented a weekly output of some 300,000 Rifle components.

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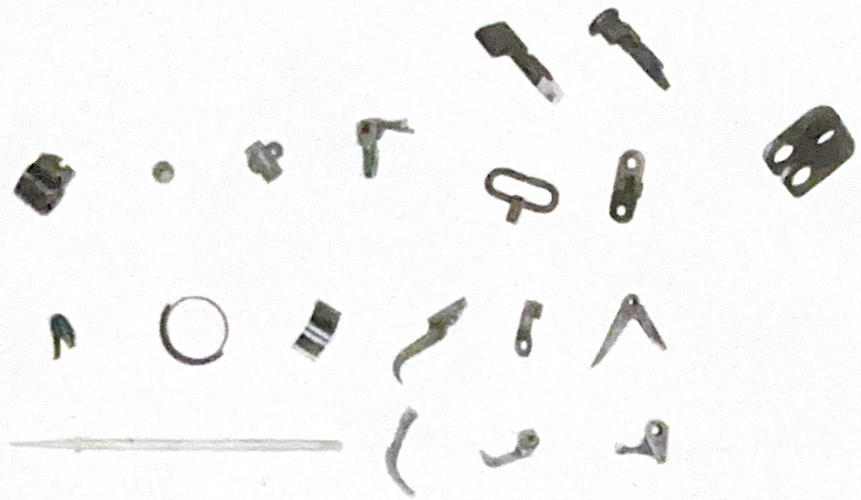
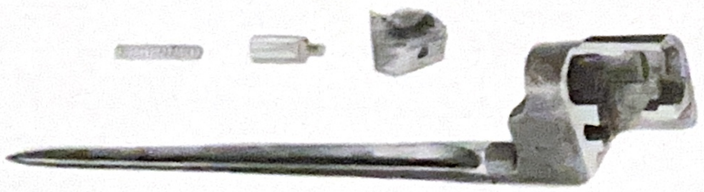


OTHER RIFLE COMPONENTS

RIFLE BAYONET No. 4 MARK I.

Coincidently with the Mark IV. Rifle Component programme the manufacture of the Mark IV. Bayonet was undertaken and much of the success in the production of the Bayonet Forging to close limits was due to the long experience and skill of the Drop Forging Die Makers and Stampers. In consequence, it was possible to utilise, with modifications to existing machines, plant which under normal forging tolerances would have been considered much too light for such work but which, as events proved, stood up to the job of completing some 1,293,600 Bayonets at a peak production of 10,000 per week.



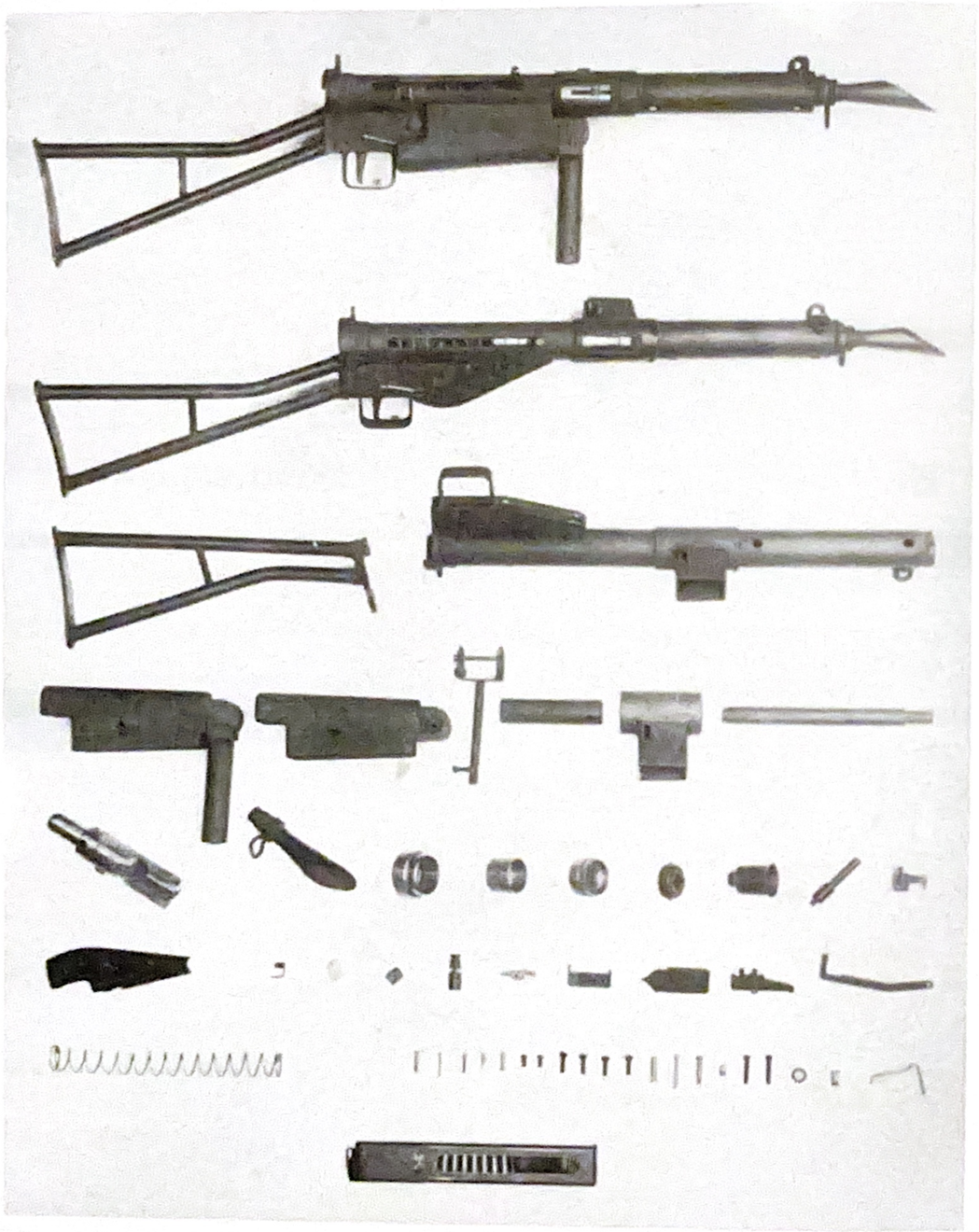
STEN GUNS

During the critical period following the evacuation of the British Army from the Continent at Dunkirk, with consequent heavy losses of equipment of all kinds, imperative need arose for a weapon of small calibre capable of being produced in large quantities and with far less delay than the production of a modern rifle. Out of this requirement was born the Sten Gun, and the Company was invited to attend preliminary conferences at the Ministry of Supply to discuss the project with particular regard to the choice of materials and manufacturing technique, and to undertake production.

At the Factory the problems of converting existing plant proceeded apace. Floor space was cleared in the Cabinet Department to permit of its appropriate arrangement and as each item of plant became available from the Tool Room the personnel was put on to the job for training.

The photographic illustration at the top of the next page reveals that the original gun carried wooden fittings which possibly gave it certain advantages in handling while firing, but made the gun rather heavier and bulkier than later models.

Operations commenced with a carbine casing, a steel tube 20″ long and with a bore of $1\frac{3}{8}$″ dia., in which the various apertures were machined or punched. The tubes were then degreased and tinned. At the next operation the magazine housing and barrel



seating were located in position on the tube and soldered in place in specially made pots, use being made of the meniscus effect to achieve the desired result. At subsequent operations the various auxiliary parts were added to the casing by means of riveting, oxy-acetylene and arc welding. At the welding operations the maximum use of jigs and fixtures was made with dispositions to avoid distortion as far as possible.

The necessary sizing and dressing operations were carried out in milling machine or lathe, as required, and at this stage the breech block cocking handle and safety slots were punched and holes drilled in the trigger box for the mechanism.

Alignment of the sights to the barrel was performed in a fixture which located the barrel positions and the back sight, so that the firing would be within the limits of accuracy required.

For rust prevention the completed casings were shot-blasted and merilised to a dull black.

A multiplicity of milling, drilling, turning and grinding operations covered the production of the breech blocks and other mechanism parts required for the complete Carbine.

After gauging and inspection, the Carbine casings and small parts were delivered to the assembly section where the weapon was completed. The functioning of the breech block, tripping lever and trigger was checked at this stage and, if satisfactory, the Gun was delivered to the range for firing tests with live ammuntion.

It is noteworthy that, with the exception of the sandblasting operation on the casing, the whole of the work, even to the firing of the guns on the Range built within the Factory premises, was accomplished with female labour under male supervision, a very large percentage having had no previous experience whatsoever of factory work.

At peak some 5,000 guns per week were made, with a total production of approximately 300,000.

BULLET CORES

The Screw Department rapidly became involved in a great variety of contracts for the various Ministries and private contractors from late October 1938, throughout the whole of the war period, and in addition to maintaining urgently needed Sewing Machine parts and spares, succeeded in contributing something like 313,000,000 components produced to the highest standards of accuracy.

Prominent in this array of work was the manufacture of Armour Piercing Bullet Cores, starting with a modest production of 250,000 per week.

Heavier and still heavier demands were made on the Company and it became necessary to build a further battery of suitable plant, until at the peak of production some 65 machines were operating round the clock to fulfil requirements.

Some 17 tons of steel bars 10 to 12 ft. long, were handled weekly. Each bar was passed through Centreless Grinding Machines to remove some 7 to 8 thousandths of an inch from its diameter. It was thus possible to utilise very simple Forming Machines for shaping the point and cutting off the bullets to length.

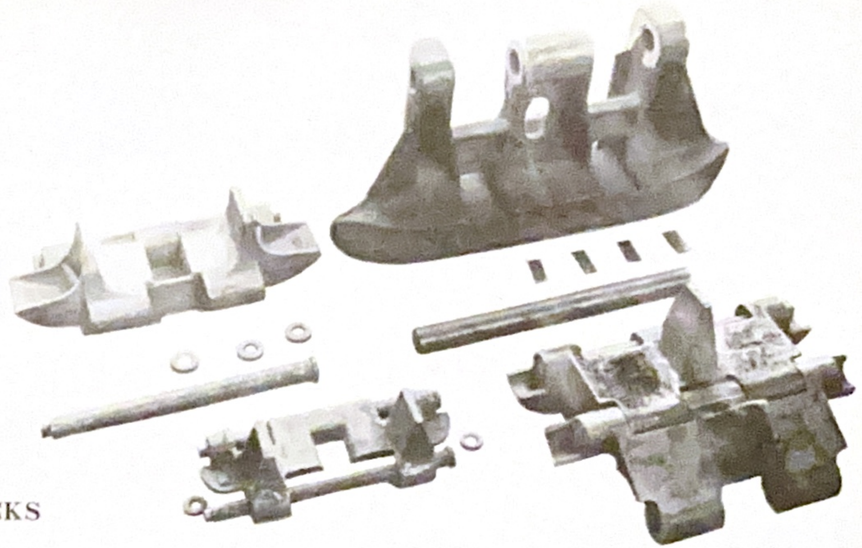
Those versed in the technique of turning alloy steels in which each of the countless parts must respond to a point no larger than eight-thousandths of an inch, and not show any trace of chatter or damage, will appreciate the problems which Singer technicians and operatives had to overcome. Suffice to say that 3,300 miles of steel were successfully converted into the colossal figure of more than 125,000,000 bullets, each carrying a hardness figure of 850 Vickers and reaching a peak production of 1,750,000 per week.

◄ MOULDING MACHINES

ELECTRIC FURNACES ►

◄ COILING TESTS

TRACK LINKS



TANK TRACKS

During the month of September 1940, the Director of Iron Castings of the Ministry of Supply visited the Singer Factory and invited the Company to become a member of a Group to be formed for the production of Track Links for the Churchill Tank.

The offer was accepted and immediate arrangements were made for Singer technicians to work in collaboration with the Ministry of Supply consultants to lay out a completely new mechanised Foundry for the manufacture primarily of the Churchill Track Link.

In due course the scope of the project was enlarged to allow of the production of Pins and Washers so that complete tracks could be assembled and shipped.

With agreement reached on buildings, layout and equipment, contracts were placed with Structural Steel Makers for the buildings. Electrical Melting Furnaces, Heat Treatment Furnaces, Moulding Equipment, Conveyors, Moulding Machines, Core Making Machines, Metallurgical Laboratory Equipment and Ovens were allocated.

Selected Iron Foundrymen in the Company's employment were sent to an established Steel Making Company to acquire a working knowledge of the new technique and on the 12th October 1941, the huge charging buckets were filled for the first time with the 4 ton-charge required by the Electric Melting Furnace, the charge being transferred some 1½ hours later to the Receiving Furnace, proceeding thereafter in a steady flow from its pouring spout into pouring ladles and thence into the sand moulds.

A meticulous examination for tiny cracks and small holes had to be made, together with careful measurements for both size and parallelism of Track Pin holes to ensure that the assembled tracks were correct to length, profile and wrap on the Tank Driving Sprockets, and devoid of influence on the steering features of the Tank.

With all these conditions fulfilled, strenuous testings of sample tracks under service conditions were carried through to destruction by the Inspectorate of Fighting Vehicles on Test Tanks.

Some 60 tons of Manganese Steel were melted and poured each working day of 24 hours with never a pause except to replace furnace linings and roofs at requisite intervals. When operations were suspended something like two million track links for various Tanks had been produced, sufficient to equip approximately 15,000 Tanks with complete Tracks.

In undertaking an entirely new Foundry technique, it was to be expected that many difficulties would be encountered, and despite having to make various Tank Tracks, including Churchill, Valentine, Harry Hopkins, Cromwell Marks 7 and 8, and Comet Links, each presenting its own problems, the reject was only 4 to 5%.

FUZES

75 m/m French Fuze.

It was only natural that this Fuze should again figure prominently among the contracts entrusted to the Company because of the facilities available and its enviable reputation for this class of work acquired during the 1914-1918 War.

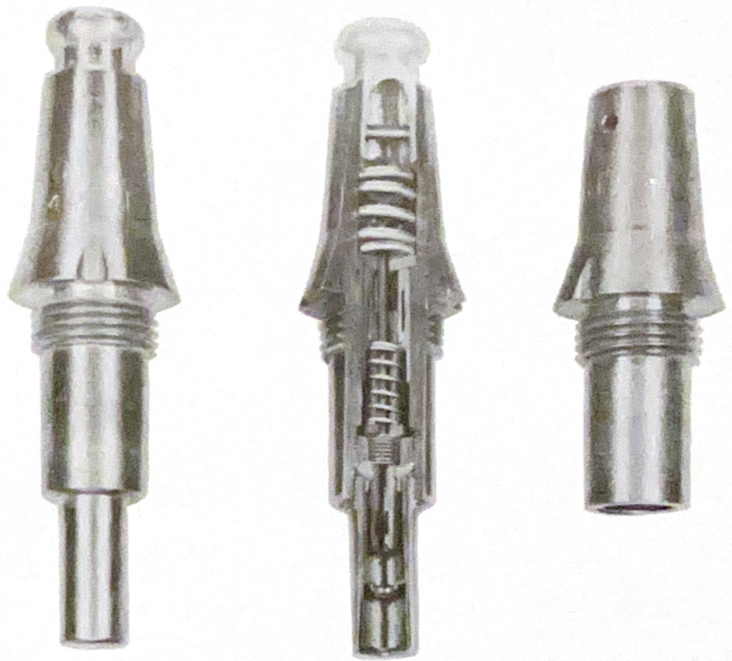
The first of these projects came from the Ministry of Supply who authorised the production of the 75 m.m. Fuze on behalf of the French Government.

At this time affairs in France had reached a very critical stage and the only information available as a basis for manufacture consisted of one or two sample fuzes, which were dismantled at Singer Factory and handed to skilled measurers to determine the precise sizes of the various components.

Hardly was this under way when France collapsed and the fate of the project came into question. Following a hurried visit to the Ministry of Supply, it was decided to proceed at a modified rate of production, namely, some 5,000 Fuzes per week.

As time went on and succeeding contracts were placed, the weekly rate of production increased until it reached a peak of 40,000, and altogether 1,250,000 complete Fuzes were made.

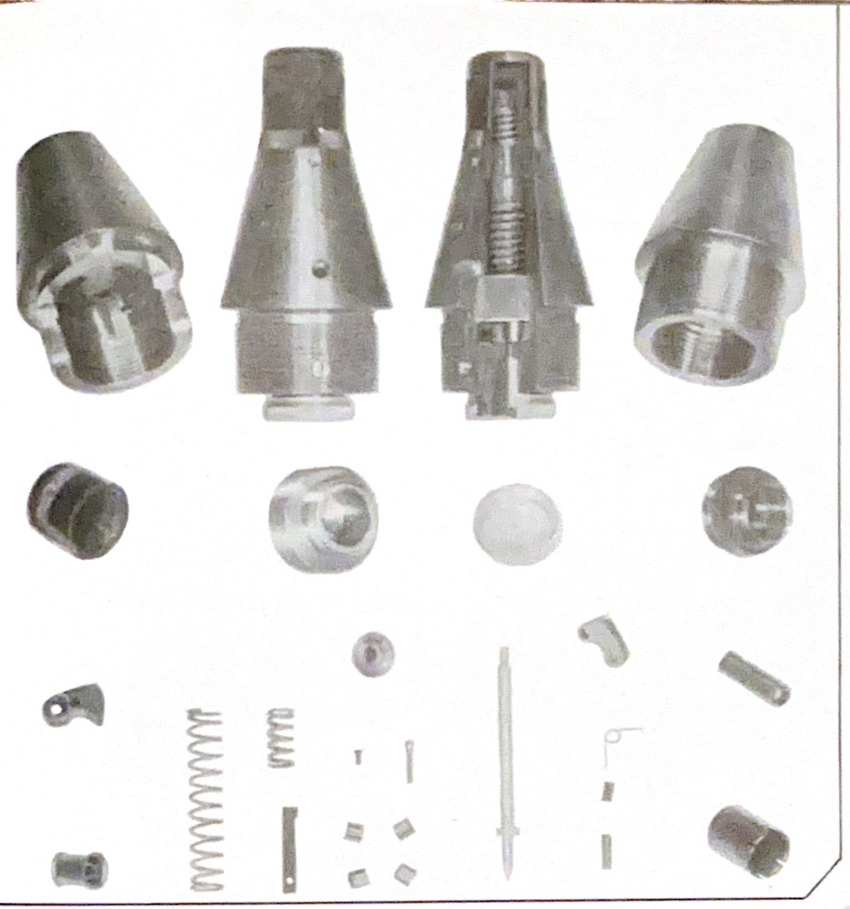
It is of interest to note that the production staff employed on this Fuze consisted entirely of female labour, even to the operating of the Six Spindle Automatic Lathes on which the main Fuze Body was made.



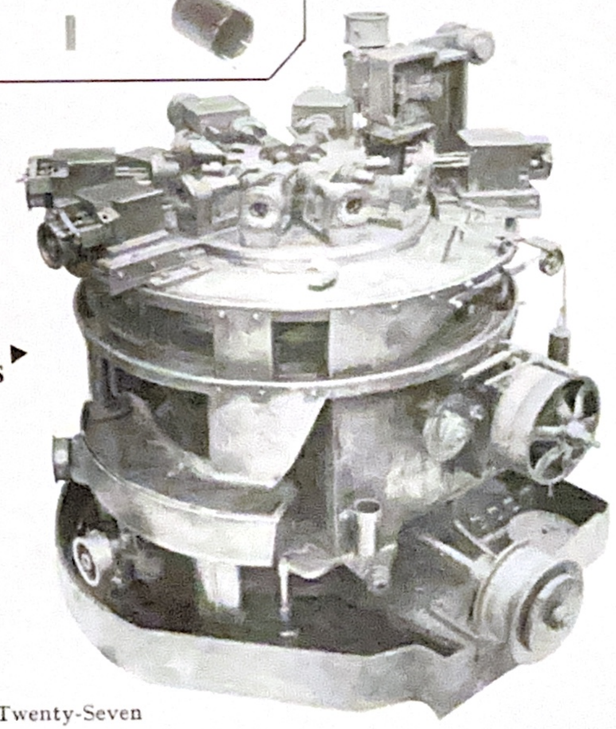
No. 117 FUZE

Towards the end of November 1940, the Company was entrusted with a first contract for the manufacture of the No. 117 Mark V. (Empty) Fuze. The hot pressings for the Fuze Body, as well as the die castings for the Nose and Magazine Caps, and certain of the 6-Spindle Automatics for the preliminary operations on the Fuze Body, were provided by the Government, in addition to other 4 and 6-Spindle New Britain Automatics for the production of such parts as the Guide Bush, Bottom Cap and Magazine.

Altogether 699,000 of these Fuzes were produced and, at peak, the figure reached 30,000 per week. In addition 1,903,090 component parts were made for the Ministry and a considerable number for other sub-contractors. At certain periods during the run of the contracts the supply of these components was as high as 20,000 per week.



SINGER STATION MACHINE
CONVERTED TO DRILL ALL HOLES ▶



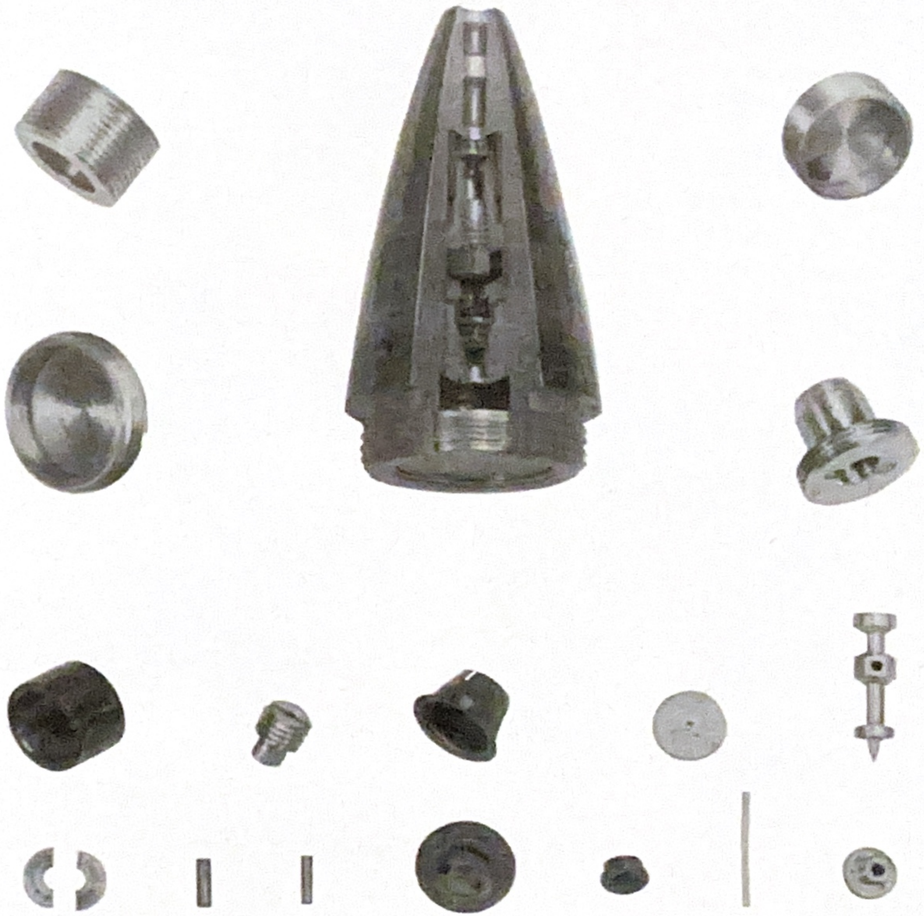
No. 370 FUZE

During April 1943, a meeting was convened at the Ministry of Supply of potential contractors, representatives of the Ministry and the appropriate Inspectorate for Fuzes, at which sources of supply for the aluminium alloy die stampings for the Fuze Body were arranged, together with such technical details as would facilitate the production of the various components. A contract for 200,000 No. 370 Fuzes, at the rate of 10,000 per week, was accepted by the Company, and as there was now a reduced demand for the No. 117 Fuze it was possible to divert some of the plant to the new product. By August of that year samples had been submitted for approval and proof, and, thereafter, production proceeded and reached the required demand.

No. 246 HYDROSTATIC FUZE

At about the same time as the contract for the No. 370 Fuze was undertaken on behalf of the Ministry of Supply, the Admiralty offered a contract for the manufacture of 800,000 sets of nine components for a Hydrostatic Fuze, to be delivered at the rate of 150,000 sets approximately per month.

Tools, gauges and equipment had to be made but it was possible to divert both plant and personnel hitherto engaged on the No. 117 Fuze. In consequence, the contracted quantity was delivered in less than five months, a performance that reflected credit on all concerned.

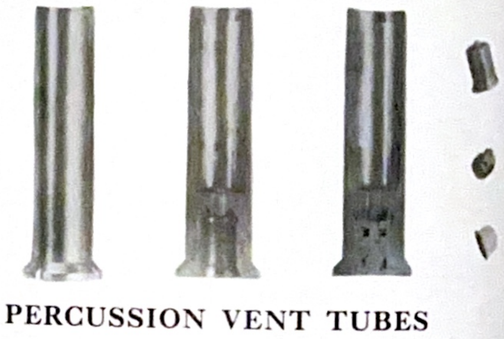


No. 370 FUZE

OTHER CONTRACTS

Store	Date	Quantity
26 Primer	Sept. 1940	1,137,000
18 Primer	Aug. 1940	340,000
Percussion Vent Tubes	Jan. 1941	320,000
Lewis Gun Spares	Dec. 1940	87,000
Grenade Needles	Dec. 1940	2,796,000

26 PRIMER



PERCUSSION VENT TUBES

18 PRIMER

GRENADE NEEDLES

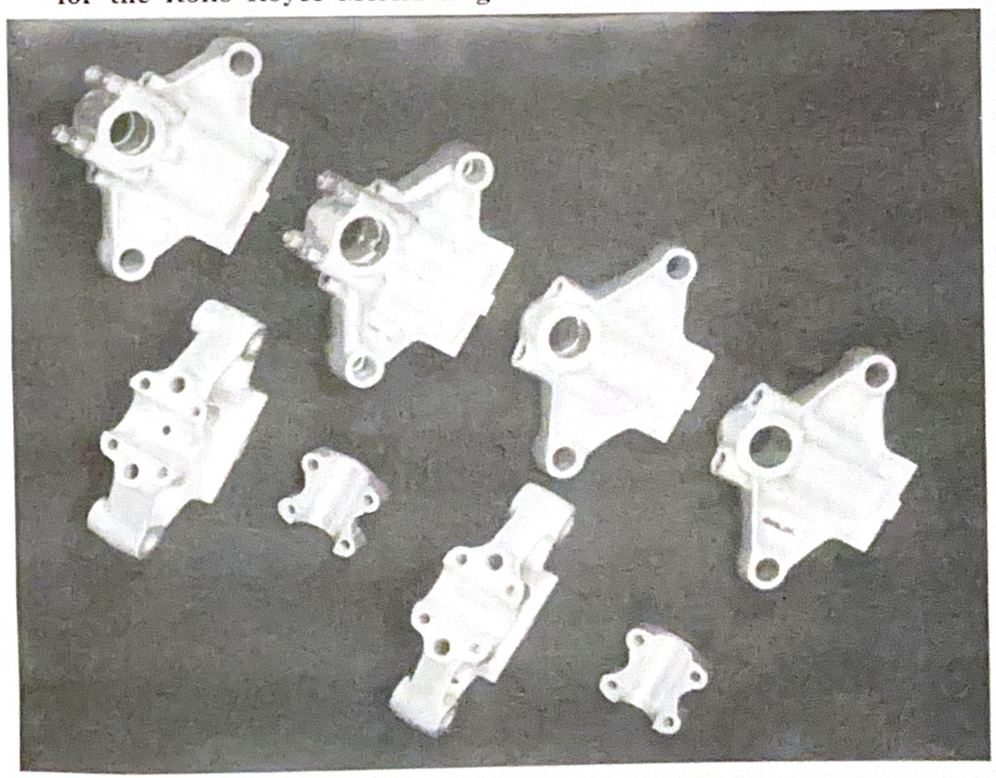
LEWIS GUN BOLT

SUB-CONTRACT WORK

Despite the many contracts placed directly by the various Ministry Departments, large commitments were undertaken on behalf of private manufacturing concerns engaged in the War Effort. Among the most important were those for the Aircraft Industry, more than 130,000,000 component parts being made and delivered.

ROLLS-ROYCE AERO ENGINES

There is a special pride in having been very intimately associated with the production of many important components for the Rolls-Royce Merlin Engine.



MERLIN ENGINE CAM SHAFT BRACKETS

As early as 1939 the Company was approached to assist in the manufacture of the Camshaft Brackets for this famous engine. Plant was made and installed in the Dry Milling Department, and the Finishing Operations were conducted in the Sewing Machine Assembly Departments.

Perfect interchangeability was essential, and many manufacturing difficulties were encountered as the brackets were mounted in line on tenons on the engine to provide close fitting and free running bearings to the rocker cam shaft.

In the early days of production it was believed that the only way to secure a perfectly flat seating on the bottom bolting tenoned seating was by the hand scraper method of skilled fitters, but speedier means became necessary as demands increased. Lapping was precluded by Rolls-Royce Engineers and so it was decided to utilise High Speed Boring Heads to produce flat faces. Singer designers and toolmakers quickly converted Cylindrical Grinding Machines, replacing the Grinding Wheel with the high speed Boring Heads and providing Fixtures for presenting the bolting face of the Camshaft Brackets to the Flycutters mounted in the Boring Heads. What had hitherto been a highly skilled toolmaker's job became overnight just another precise machining operation for men whose previous experience had been confined to Sewing Machine assembly.

MERLIN ENGINE COMPONENTS

Well over half a million Brackets were completely machined, each of which required 34 operations, and when the contract expired Messrs. Rolls-Royce, Ltd. paid the Company a tribute by purchasing this Singer-designed-and-made Plant in its entirety.

It is of interest to recall that so urgent and persistent was the demand for Aircraft that the Plant ran continuously, except for a break of 12 hours every five weeks when the shifts of workers changed over.

AIRCRAFT DETAILS

In addition to the Camshaft Brackets for Rolls-Royce Limited, many other engine details were made for the Merlin Engine, as well as great quantities of components for the Wellington Bomber and the Sunderland Flying Boat.

WELLINGTON BOMBER COMPONENTS

HOSE CLIPS

This subject, of which a photograph is shown, is interesting from an engineering viewpoint and typical of the type of problem met and overcome daily during this strenuous period.

The clips were required at very short notice and in large and constantly increasing quantities at a time when the Company's Automatic Screw Machines were loaded to full capacity. It was doubtful, however, if the screwing could be satisfactorily accomplished on the Automatic Machines and a new composite style of Thread Rolling Die was designed and used with such success that within four weeks deliveries were being made at the rate of 50,000 per week, rapidly increasing to a maximum of 400,000 per week.

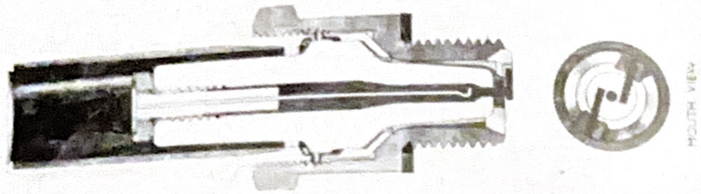
Altogether well over 17,000,000 were delivered with such satisfaction that the Contractor recorded his appreciation as follows :

> " I would also like to record the efficient way in which our orders for screws have been carried out, and I can assure you that, except for your help, the M.A.P. would not have received the adequate deliveries of clips which we have been able to make. I know the Department is very pleased with our efforts, but they would have been in vain if we had not received screws from you as no other manufacturer whom we have approached has succeeded in producing satisfactory screws."

AIRCRAFT SPARKING PLUGS

Towards the end of 1943 an invitation was received from the Ministry of Aircraft Production to participate as a sub-contractor to the K.L.G. Company in a programme designed to enable that Company to expand rapidly its production of Sparking Plugs for Aircraft Engines and also to ensure an alternative source of supply in the event of interruption of output by enemy action.

A short time was spent by Singer technicians at Messrs. K.L.G. Company's plant to review methods and acquire a knowledge of the special plant required to produce the Plug Body and Gland Nut, for a weekly output of 20,000 of each.



The most important items of plant, consisting of Gridley Multi-Spindle Automatic Turning Machines for the main turning operations and Thread Milling Machines for the Threading of the external threads, were provided by the Ministry of Aircraft Production, otherwise the whole of the remaining machines, jigs and gauges were designed and made by the Company and rapidly installed.

A few skilled Setters were drafted from the already overtaxed Factory personnel and, with these exceptions, female labour exclusively was engaged and trained for this work.

The milling of the external 18 m.m. thread on the Plug Body is typical of the extreme care and close attention demanded to ensure a satisfactory inspection standard in terms of concentricity, roundness and the very fine limits permitted on the effective diameter of the threads.

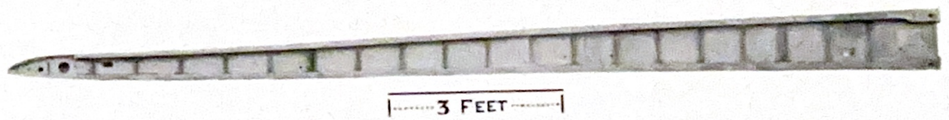
With a Brinell Hardness rising frequently to 255 this extremely tough High Tensile Steel caused the regrinding of the Ground Form Thread Milling Cutters for every 60 parts, and inspection and resetting of the Snap Thread Gauges every four hours.

The sureness and skill exercised in the placing and cutting off of the Platinum points prior to welding in position testified to the merit of both supervisors and female operators. So well did this team perform that a weekly production of 20,000 of each component was attained and altogether 1,250,000 parts were completed and delivered.

SPARS FOR LANCASTER BOMBERS

Mention has already been made of the large variety of Aircraft components made, not only for the Ministry of Aircraft Production but for Aircraft Manufacturers generally. Large commitments had been undertaken for the factories of the Vickers' Group mainly engaged in the production of their own Bomber Aircraft, the "Wellington."

In due course the Chester Plant of the Vickers Company became interested in the Lancaster Bomber, a product of Messrs. A. V. Roe & Co., Ltd. and the Singer Company was invited by Messrs. Vickers to undertake on their behalf the production of Outer Wing Spars for the Lancaster Bomber, of which a photograph is shown below.



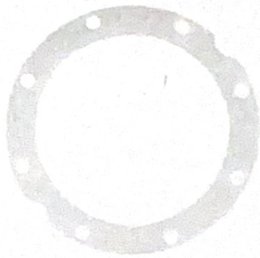
Arrangements were speedily made to obtain the special Boom Milling and Drilling Machines from outside sources, and the Tool Department designed and made the very large Milling Fixtures and Drilling Jigs to ensure complete interchangeability of the various details of each individual Spar and also that Singer-made Spars would drop into correct position with their mating components in the Aircraft Wing Assembly.

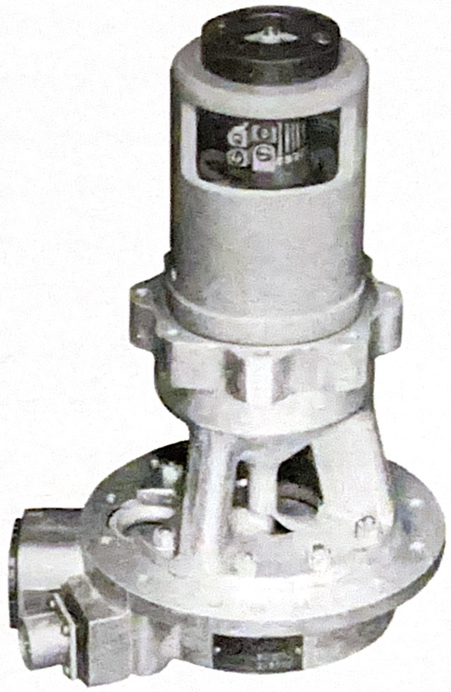
With the exception of the Radial Drilling of the main locating holes and a boom bending operation of a heavy nature, the whole of the work on this highly important Aircraft component was performed by female labour to the complete satisfaction of the Aeronautical Inspection Department and Messrs. A. V. Roe & Co., Ltd.

Owing to changes in the constitution of the Group undertaking this work, the project had barely got into its stride when orders were cancelled, but not without it having been demonstrated once again the adaptability and resource of the Company's technicians and personnel in overcoming any manufacturing problem submitted to them.

SUBMERGED SELF PRIMING PETROL PUMPS

The purpose of the electric motor pump was to deliver high octane fuel to the power units of service aircraft, in adequate volume and free from æration, so that the operational ceiling could be maintained at a maximum.





As the conditions under which the pump might have to operate at an altitude of 30,000 ft. could be extreme, the standard of manufacture had to be high and the testing of the unit stringent so that the risk of failure might be obviated.

The driving motor was of the compound type for a 12 or 24 volt power supply and fitted with ball bearings.

On the shaft extension of the armature was carried the bellows sealing gland, de-ærating fan and the pump impellor.

The top frame of the pump, which also formed a seat for the motor, was a three-legged die-casting of aluminium. A passage through each leg carried the leads connecting the motor to the power plug, air for ventilating the motor and any petrol which might have escaped through to the motor.

The pump base, also a die-casting of aluminium, had formed within it an involute space in which the impellor functioned. Around the outside of the base was a flange for mounting the unit to a petrol tank.

Self-priming was affected by a flap valve mounted in the outlet, which, when the pump was stationary, allowed fuel from the reservoir through to the supply pipe. When the motor was driving the pump, the pressure of the fuel forced up the valve flap and held it closed, so that the fuel was confined to the supply pipe and thus forced to the aircraft engines.

After assembly, the units were transferred to the Test

House where they were fitted to petrol tanks and made to circulate high octane fuel under observation by means of flowmeter and pressure gauge, and electrical consumption was also checked.

At various intervals a unit was taken from production and submitted to 500 hours' endurance test, during which the air pressure above the fuel in the test tank was varied to represent the reduced atmospheric pressure which would obtain at an altitude of thirty thousand feet.

The capacity of the pumps was five hundred gallons per hour at a pressure of 6 lbs. per square inch, with the motor taking 9.8 amperes on a 12 volt circuit.

During the period of the contract, more than 7,000 of these Fuel Pumps were produced.

JACKET LIGHTS

This equipment was designed for the use of Royal Air Force Crews to enable each individual to mark his location in the event of having to bale out over the sea at night. The R.A.F. type consisted of a battery container with a flexible lead connected to a wooden float carrying a bulb. The switch was also embodied on the float but, ultimately, was transferred to the bottom of the battery container. It was possible to have the light on continuously, or to flick it on and off for morse signalling, if necessary.

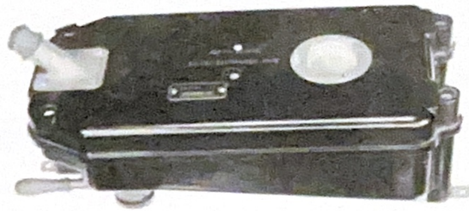
As an offspring of the original design, a model was developed for use of personnel and passengers in merchant ships.

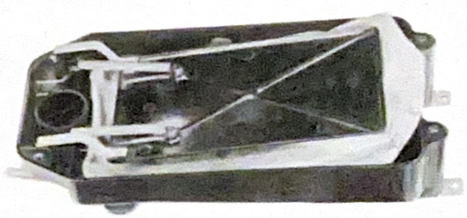
This consisted of a single container carrying the battery and the light bulb, with a switch to enable the light to be on continuously or to be flicked on and off as in the case of the R.A.F. model. The container was anchored to the person by means of a lanyard and was of such dimensions as to enable it to float with the lamp upwards. Many improvements and changes in design were introduced in the course of the production of these Lights, but despite this nearly 1,000,000 were supplied by the Company.

Another development from the Merchant Service Light was the Marker Light, which consisted of a Jacket Light to which a spike was added for inserting in the ground. The Marker Lights carried various coloured domes, which indicated to pilots the runway, obstructions, etc., when landing on temporary air fields.

OXYGEN ECONOMISER

This instrument enables the oxygen supplied to aircraft crews to be used in a more efficient manner than formerly, thereby reducing the weight of oxygen and container and permitting of the accommodation of more armaments or fuel.





The principle of the instrument is as follows :—

The Economiser consists of a spring loaded flexible bag provided with (1) an inlet which is connected to a suitable oxygen regulator and (2) an outlet comprising a very sensitive spring loaded mica valve, the purpose of which is to pass oxygen from the storage bag to the mask when inhaling and, automatically, to cut off the supply when exhaling. During exhalation the flow from the oxygen regulator inflates the storage bag until the pressure in the bag reaches a maximum, or until the user inhales, when the valve trips automatically and the bag is deflated, the oxygen contained being released to the user. When the bag is completely deflated, the valve seals automatically and cuts off the oxygen supply. In use, the inflation and deflation of the storage bag coincide with the exhalation and inhalation respectively by the user. The spring loaded bag and valve mechanism are housed in a protective dust proof bakelite case. The materials used in the construction were the finest obtainable and, as far as possible, were corrosion and shock proof.

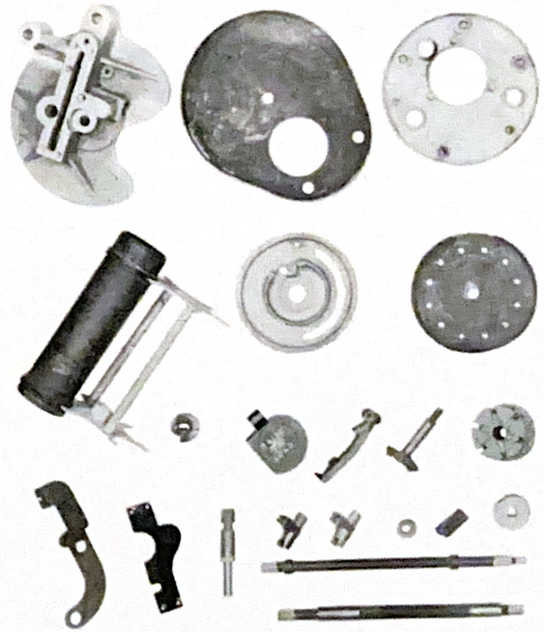
The instruments were tested with compressed air, which had been specially dried and filtered to exclude any trace of moisture, each instrument being tested to ensure correct functioning over the range of oxygen flow specified, i.e., from 2 to 12 litres per minute. In addition, a proportion of the instruments was subjected to vibration tests for a period of 10

hours, the vibrations being varied over the range experienced in aircraft. Economisers were also subjected to cold chamber tests to ensure correct functioning over a temperature range of +20 to —40° Centigrade.

SIGNAL DISCHARGERS

In September 1940, a Ministry of Aircraft Production contract was received for Signal Dischargers, complete with Remote Control, for use on Fighter Aircraft.

The manufacture of the several parts was distributed over the regular producing Departments of the Factory. The Assembly and Adjusting Department was allotted the task of manufacturing some details, the principal of which was the nest of six gun barrels required for each discharger, and the Geneva indexing motion as well as the assembly, adjusting and firing test of the complete unit.



The position in which this Signal Discharger was fitted on Fighter Aeroplanes, the nature of its duties, and the imperative need for absolute reliability, made the assembly a most exacting task, but with the co-operation and advice of the resident representative of the Chief Inspector of Small Arms, a most satisfactory store was produced at the rate demanded by the services. 9,000 Signal Dischargers were completed by March 1943, by which time the device had been superseded by radio signalling.

SIGNAL PISTOLS

During November 1942, when a definite period had been put to the life of the Signal Discharger contract, the Company undertook the manufacture of Signal Pistols for use, principally, on Bomber aircraft. A similar scheme was adopted as for the Signal Discharger, the Assembly and Adjusting Department undertaking the manufacture of barrels and the assembly and adjusting of the complete Pistol.

This store created many problems in production, the parts being made to engineering limits with tolerances of the order of .0005" and .001", whilst the complete assembly required to be of Gunsmiths' fits and finishes.

The Pistol contract was completed in September 1945, when a total of 26,800 Pistols had been made, tested and accepted.

CHEMICAL SHELL CONTAINERS

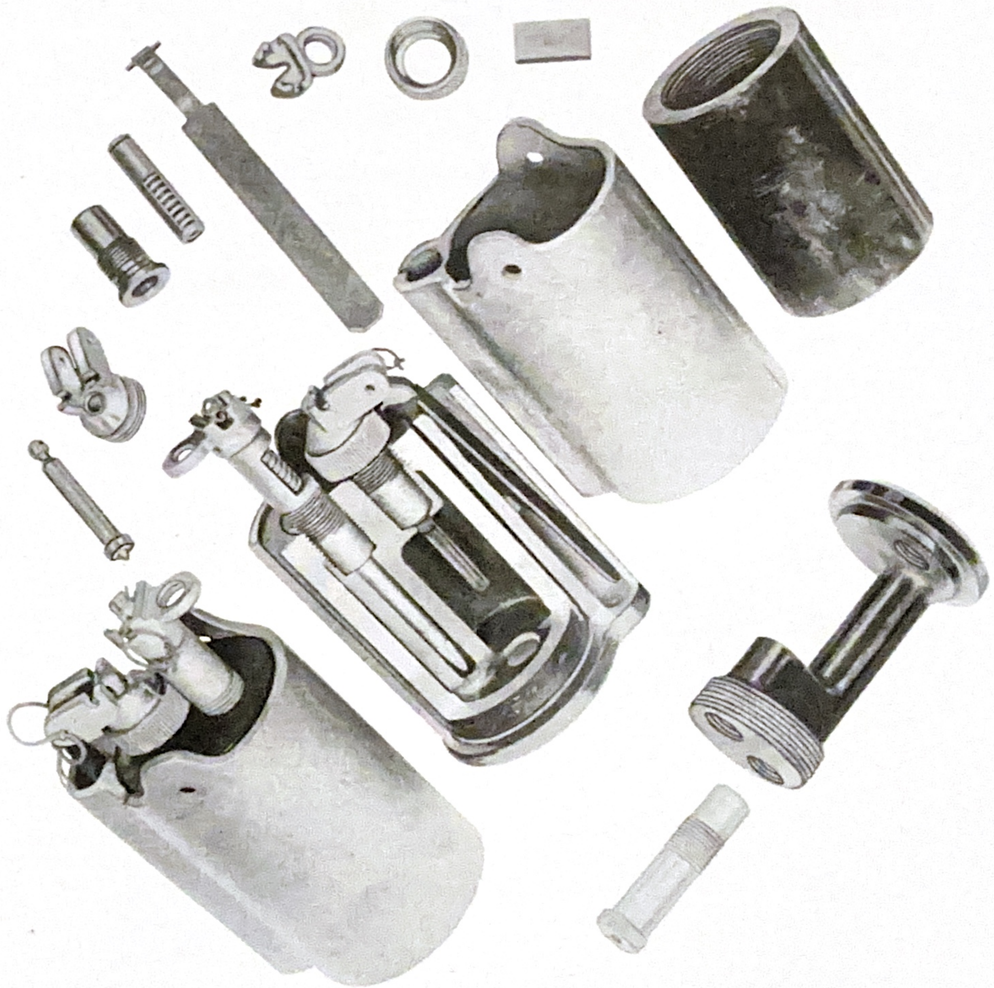
In this contract the Plant was taken over from a Machine Tool Company, who, in addition to building the large Hydraulic Shell Turning Lathes, had intended to carry through the production of the Shell itself. Owing, however, to the heavy demand for Machine Tools at that period, Singer was invited by the Ministry of Supply to take over the Plant.

Space was cleared in the Cabinet Building and the Plant assembled, tooled up, and personnel trained for a dayshift and, thereafter, as rapidly as possible expanded to include nightshift working also.

After difficulties with the Hydraulic Feeding system had been overcome and the necessary degree of uniformity established with the steel forgings from which the Shells were made, a steady production was achieved of 8,000 Shells per week for a total delivery of some 400,000. The whole of this production and inspection was handled by female labour, with the exception of a few skilled male setters.

MINE SHRAPNEL MARK I.

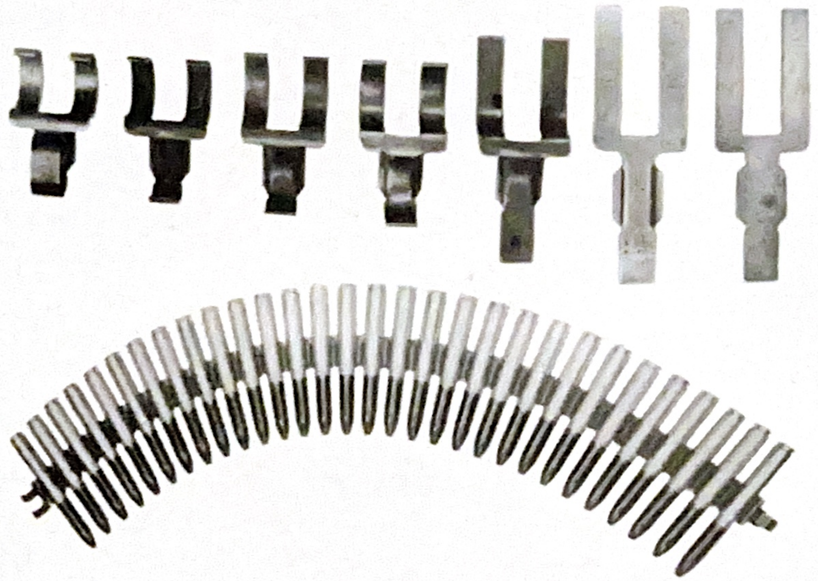
Towards the middle of 1940 a preliminary contract of some 50,000 Mines, together with Cartridge and Detonator Pistols, was offered for delivery at the rate of 10,000 per week.



The Company was particularly gratified to receive this contract because the major components, consisting of the Mortar, Sleeve and Body, were of cast iron, for the handling of which material considerable capacity was available. The Factory was also able to accept the die casting of Pistols not only for the Company's contract but for other contractors who experienced difficulty in production. On this contract the plant normally used for boring the Arm Shaft Holes in Sewing Machines was utilised to handle the work from each end of the component at one setting, a factor which contributed in no small degree to economy, speed and the high production of some 562,000 Mine Shrapnels.

20 m.m. HISPANO SHELL LINKS

One of the most interesting tasks undertaken by the Press Department was the Links for the 20 m.m. Hispano Shell, which



were in very great demand. Early in 1940, a first contract for the manufacture and supply of 500,000 Links was offered to the Company, and the Press Department immediately proceeded to design and make the complicated tools required for the nine separate operations on each link.

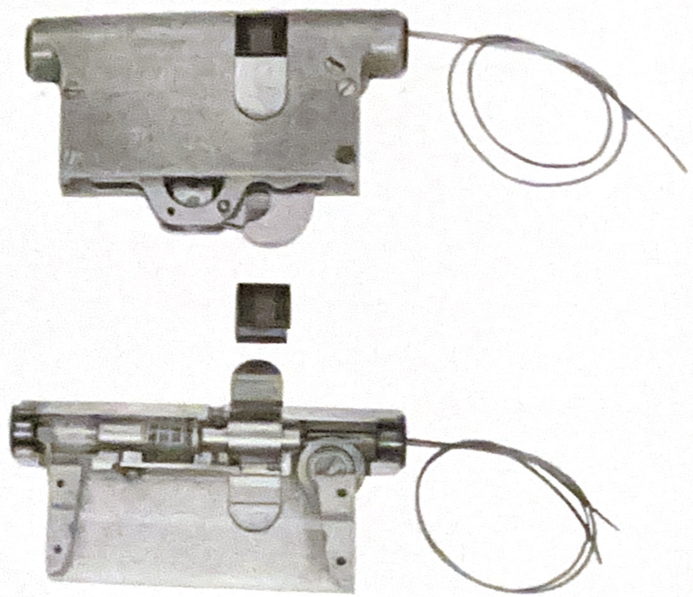
The Links, when assembled with the Shell, form a belt ready to be fitted to the Hispano Gun, the cartridge of the shell acting as the hinge. The photograph shows the successive stages of manufacture. After hardening and tempering, each Link was set and unit inspected to gauges controlling the diameter, to ensure close limits of the end pressure required to push the cartridge case into position. More than 7,500,000 Links were made, and production at peak averaged 50,000 per week.

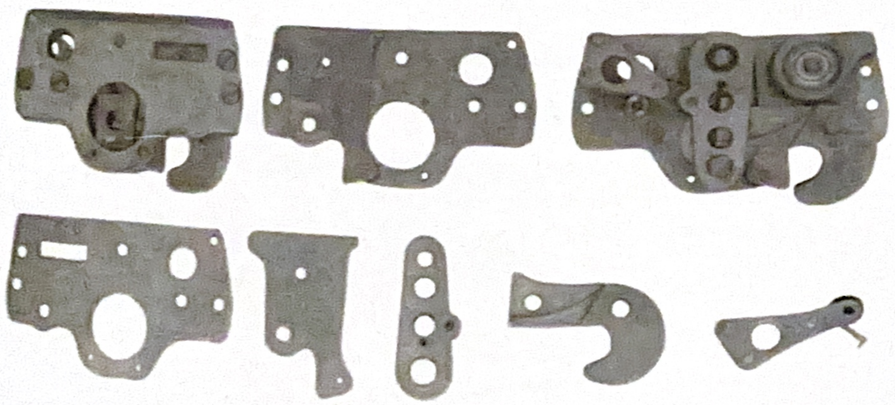
WELLINGTON BOMB RELEASE SLIPS

Among the many contracts undertaken for Messrs. Vickers-Armstrong, Ltd., one of the most interesting was the Bomb Release Slip used on Wellington Aircraft.

The first contract was for 5,000 and approximately 22,000 complete Bomb Release Slips were made, as well as considerable numbers of forged components.

Being part of the equipment of an aircraft, this Mechanism had to be made of special materials, and always with an over-riding regard for the total weight of the complete article. The Body was made of Duralumin, reduced to such dimensions of





weight that distortion difficulties were ever present owing to the thinness of the final sections. All other parts were made from stainless steel and of such precision and finish as would ensure their smooth working under all conditions encountered by aircraft, the success of whose mission depended so completely upon the Bomb Release responding at the precise instant of time selected for it by the bomber crew. In consequence, very stringent tests were demanded by the Government Inspection Department and all operating features were subjected to loads considerably in excess of those demanded under service conditions.

JERRICAN NECKS & HANDLES

The need for manufacturers who could produce parts for the Jerrican Assembly was so urgent at the time of the North African campaign that the Company undertook to make Closures and Handles at the rate of 20,000 Closures and 10,000 Handles per week.

Here again the problem was one of press tools allied to spot welding technique.

JERRICAN NECK ASSEMBLY

The Jerrican Neck performed the function of a pouring orifice for various liquids, generally petrol, and it will be observed that the actual joint, between the flange of the neck proper and the underside of the hinged lid, was made leak-proof by means of a synthetic rubber washer. It was imperative that the flange be flat and the washer capable of bedding down very closely at all points before the pressure possible with the toggle fastening came into operation. To check this feature, every component was subjected to pressure under liquid of 15 lbs. per square inch.

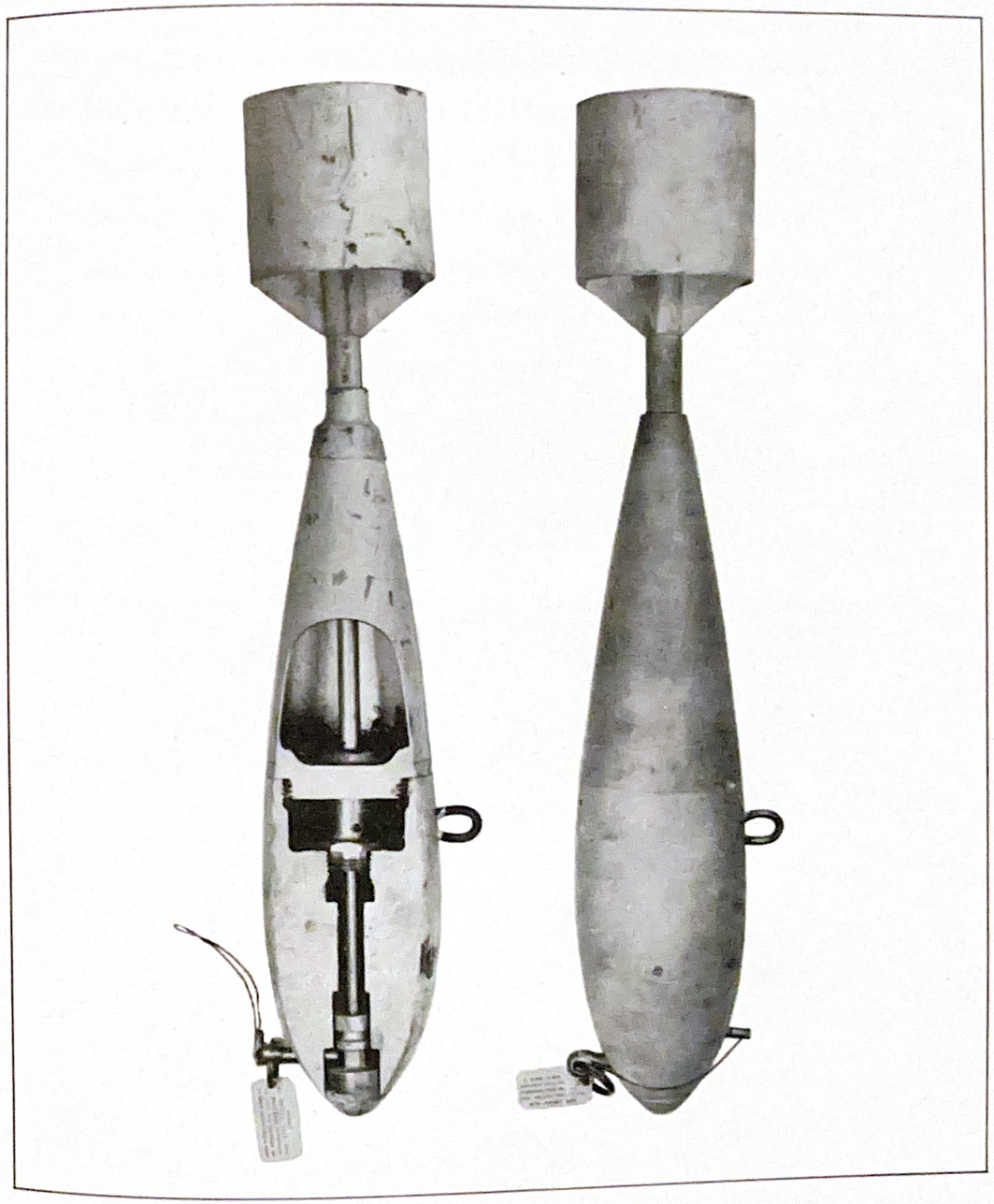
Altogether some 750,000 Closures and 500,000 Handles were delivered.

10 lb. PRACTICE BOMB

Another sample of Bomb manufacture entrusted to the Singer Company was the 10 lb. Mark I. Practice Bomb (Empty) of which an illustration is shown.

The Bomb consisted mainly of a heavy cast iron nose piece into the rear end of which was screwed a steel adaptor carrying a sheet metal tail cone.

Some 350,000 of these components were completed, at the rate of more than 5,000 per week.



INCENDIARY BOMB 4 lbs. MARK II.

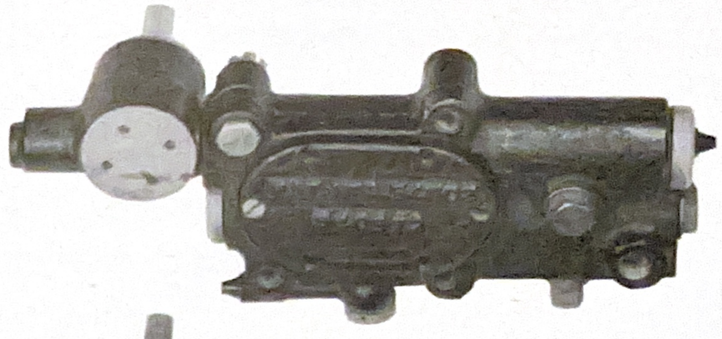
In June, 1941, the Ministry of Aircraft Production enlisted the Company's assistance, in the supply of various components for the 4 lb. Incendiary Bomb.

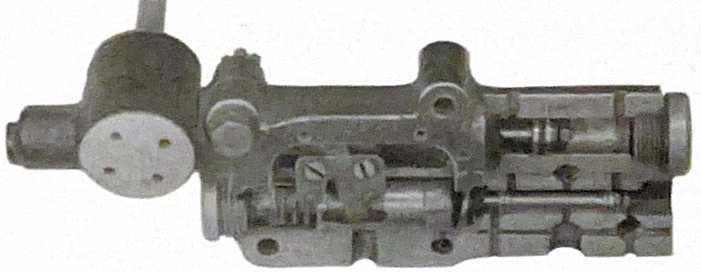
As will be seen from the illustrations, the parts varied from the turned striker with its sharp point for the purpose of piercing the detonator, to a sheet metal tail.

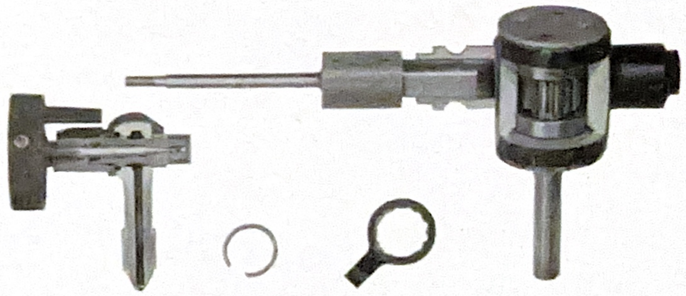
Slightly under 20,000,000 of these components were delivered during the course of this contract, peak production reaching a figure of some 40,000 weekly of each component.

WYLIE HYDRAULIC WINDSCREEN WIPER

During 1942, the Company was requested by the Inventor to consider undertaking a pilot order for the complete manufacture of a Hydraulic Windscreen Wiper to be used in Bomber Aircraft, principally the Wellington.







This consisted mainly of a small aluminium casting carrying hydraulically operated pistons and valve mechanism and functioned at a working pressure of 1,200 lbs., tested to 1,800 lbs. per sq. in.

It will, therefore, be appreciated that all pistons, plungers and reciprocating parts required to be made with the utmost precision, and the holes which carried the pistons had to be position bored and lapped to a very high degree of finish. The same technique of lapping applied to the small pistons.

A very high standard of quality was established, and the Company quickly became the principal supplier of this item of equipment.

It is of interest to record that on the pilot Wipers for use on Wellington Aircraft test conditions demanded that the leakage from the valve chest controlling the admission and cut-off of the hydraulic supply was not more than 15 drops per minute. After the initial delivery of pilot Wipers it was required that no perceptible leakage should occur.

As the apparatus was expected to work at considerable altitudes and in all conditions of weather, it was essential that the mechanism should function at very low temperatures. Indeed one of the tests demanded that the temperature of the instrument be reduced to minus 40° C. and after being held at this temperature for 30 minutes, it had to be capable of starting up

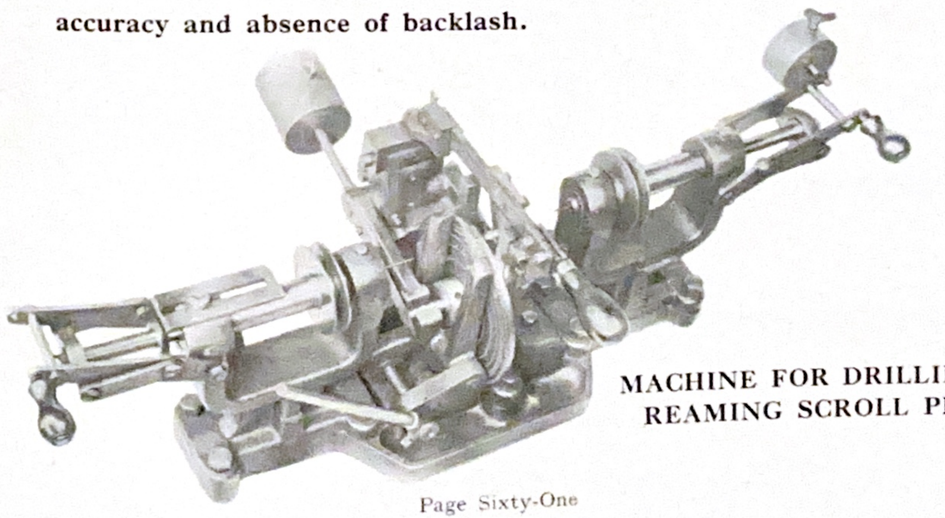
under a hydraulic pressure not greater than the maximum available pressure on the aircraft on which the Wiper was to be used, achieving a pre-determined speed within a very limited time.

It is, therefore, particularly pleasing to record that some 13,500 Wipers were produced, together with adequate supplies of spare parts for the efficient maintenance of the instrument in service.

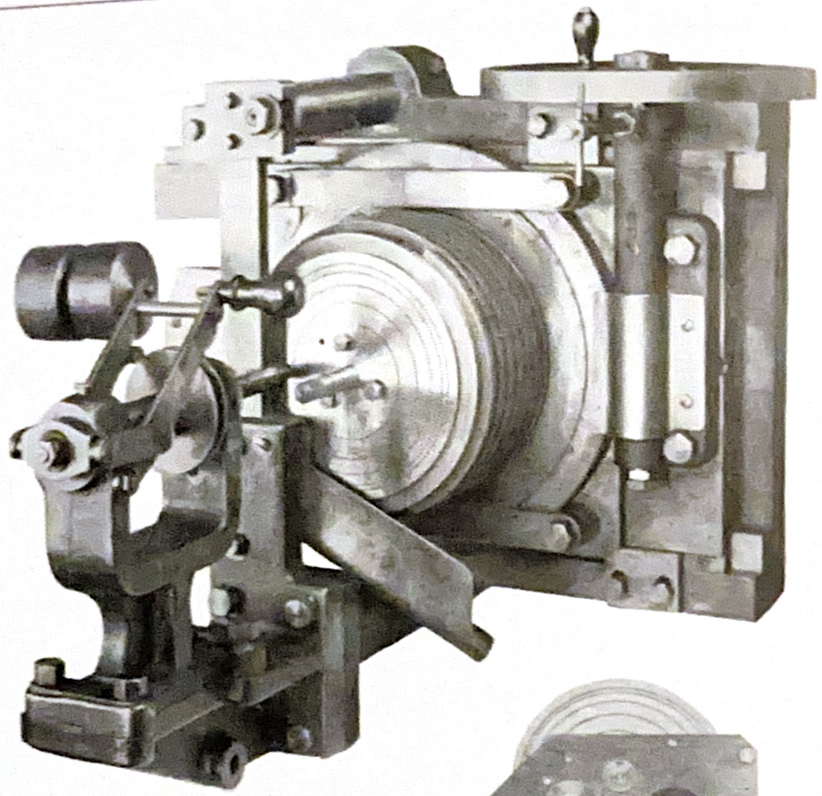
No. 7 PREDICTOR SINE UNIT

This Instrument provided a most interesting problem in tooling, and, in particular, the scroll plates which were assembled in pairs, drilled, reamed and fitted with 768 taper pointed pins. The pins formed a 72″ long rack on the face of the disc, following a spiral path which was developed from a sine curve. The diameter of the small pins was .0625″ and the total depth of all these tiny holes was represented by one hole 10 ft. deep.

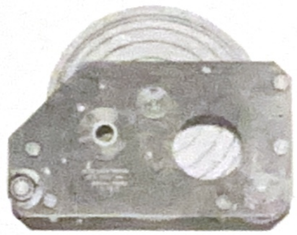
After assembly, the units were tested at 40 positions for accuracy and absence of backlash.

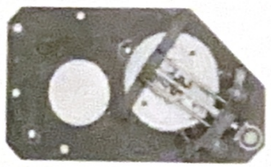


MACHINE FOR DRILLING AND REAMING SCROLL PLATES



MACHINE FOR MAKING
MASTER SCROLL PLATES





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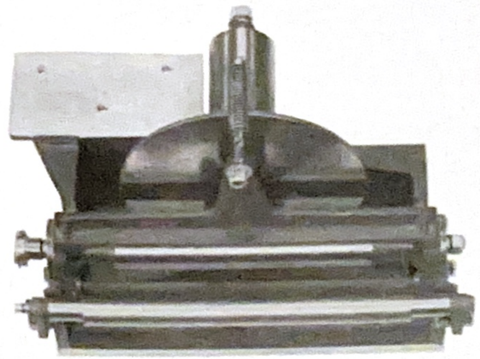
No. 3 PREDICTOR MARK II.

For this Predictor the Company was asked to supply the Constant Speed and Differential Units.

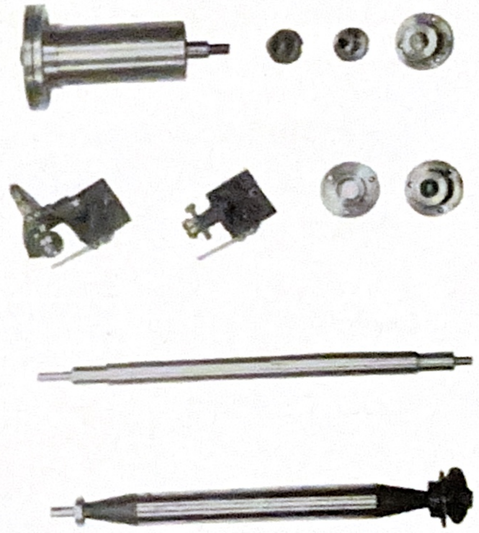
These Units were supplied in pairs, one of each unit being used to control the Azimuth and Elevation movements of the Bofors Gun.

On the Constant Speed Unit the speed was controlled by a ball moving between a perfectly ground parallel shaft and an optically flat Disc.

494 pairs of Constant Speed Units and 502 pairs of Differential Units were completed.



CONSTANT SPEED UNIT



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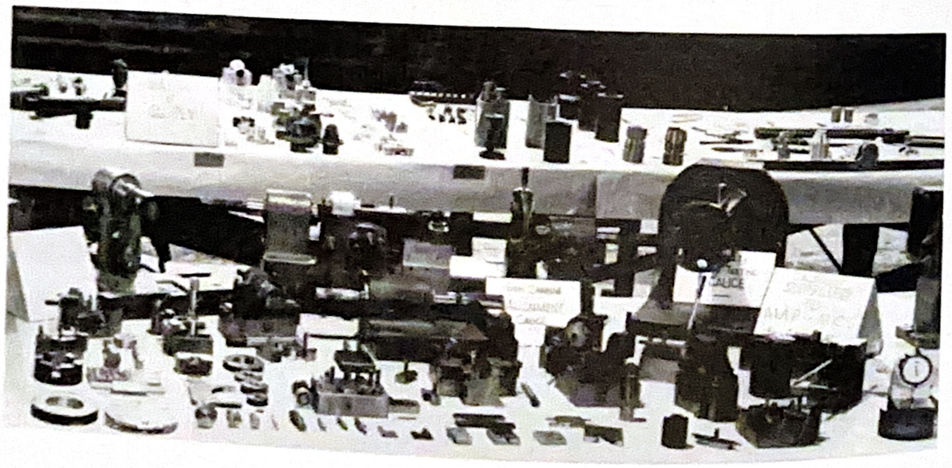
GAUGE WORK

The first gauges to be made for War Contract work were undertaken in April 1939, and from thence the Department was at peak load until late 1944, when Government Departments and manufacturing concerns generally had largely caught up with the demand.

During this time very considerable assistance was given to the Ministry of Supply, the Admiralty, and private firms of all kinds engaged on Government Contracts, who received 70,000 Gauges ranging in weight from a few ounces to as much as two hundredweights. To this must be added some 25,000 Gauges made for internal use and for which repair and maintenance was constantly required. In all some 95,600 Gauges were made, a truly formidable and valuable contribution to the War Effort.



CUTTER MAKING

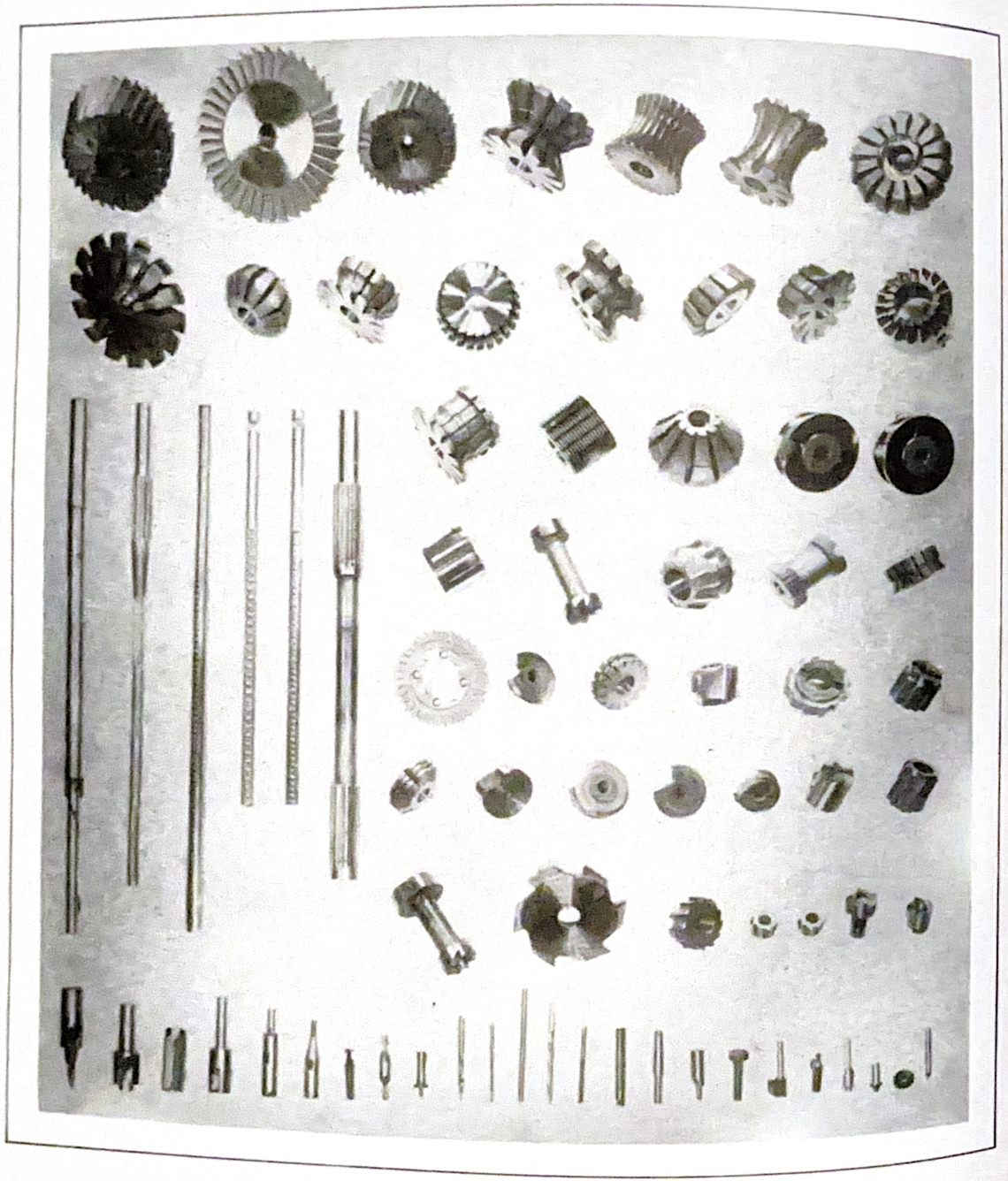
It will have become evident from a study of the preceding pages that the great variety of work was generally accomplished either by the provision of entirely new equipment or by the conversion of existing machine tools which were introduced into all the Manufacturing Departments as loading permitted.

In the case of Cutter Making, however, the problem was largely one of expansion, mainly of personnel, since the Factory had always enjoyed the advantage of making its own Cutters.

As early as November 1938, Broaches and Cutters were being produced for various Aircraft Companies and assistance in the prevention of bottleneck conditions was given to such firms as the Ministry of Aircraft Production and the Ministry of Supply indicated.

Mention has already been made of the assistance given to Rolls-Royce Ltd. and the Merlin Engine programme by the manufacture of numerous parts, but it is worthy of record that, in addition, the Company made 42,389 Cutters of all kinds for Rolls-Royce Ltd. and undoubtedly materially assisted in promoting early production in their expansion programme.

During the whole of the war period some 365,000 Cutters and approximately 250,000 Taps were also made for the Company's own requirements—a total in all of some 655,000 cutters, tools and taps, an accomplishment only achieved by diligence and skill of a high order.



HELMET LININGS, Etc.

Towards the middle of 1940, The Singer Manufacturing Company Ltd. was asked to undertake the manufacture of a million linings for civilian type steel helmets, which were lighter than the regular service helmet. A staff with the widest knowledge of stitching problems, was selected for this production. A careful study was made of the article, and sewing machines of the most modern types procured so that the work could be performed automatically as far as possible.

The new contract completely changed the structure of the department concerned from one of research to production. Five times the normal staff was required and all the new help was entirely unskilled in the use of special sewing machines.

Production commenced in January 1941, and the operators were just becoming efficient when the entire premises, with all its irreplaceable equipment, was destroyed by enemy action on the night of March 13th, 1941.

Because of Enemy bombing, the need for helmet linings was very great, and the Company was requested to resume immediate production.

The first plant had been ideally suited to the manufacture of the helmet lining as specified, but the reconstituted plant, limited in size and equipment, could produce only a small part of the quantity required.

After the difficulties were explained to the officer-in-charge of inspection it was arranged to change the design of the lining without weakening its structure. Operators were re-trained in the new method and shortly afterwards a very good production was attained and the contract finished almost on time.

At this point certain regulations came into effect in the Needle Trades that prevented the acquisition of new equipment for Government work. It was therefore necessary to select articles that could be produced on the single needle machines available, or on machines made in the Factory.

Powder Bags and Igniters were chosen as the most suitable products and these were made in a wide variety of shapes and sizes for about a year, when the Ministry of Supply cancelled the contracts for such articles. Subsequently contracts were obtained for various items, such as Knee Pads for Parachutists, Toe Covers for Alpine Troops, and small bags for the Air Force.

SEWING MACHINES AT WAR

The sewing machine is now regarded as an almost essential part of every household and this fact became more and more apparent in consequence of the scarcity of many articles, and the need to "make do and mend." In this way, the domestic sewing machine played its part in helping to maintain morale by putting in the hands of the housewife the means of providing furnishings and clothing which might otherwise have been impossible to obtain.

The demand for both Industrial and Domestic Machines during the early part of the War was very heavy, but at that time there were no serious restrictions in regard to labour, materials and quotas. As demands for War stores increased and shipping became more difficult, the Board of Trade restricted the production of Domestic Machines to small quantities for Home and export.

The industrial sewing machine is an essential means of manufacture of countless articles of every description and without it much of the equipment used and worn by the Armed Forces, and for the defence of the country, would have been impossible to produce. It is perhaps not generally realised to what extent the industrial sewing machine was responsible for the excellence of the equipment of the Air Raid Precautions Organisation during the War. The gas mask supplied to every civilian, that supplied

to A.R.P. personnel, Civil Defence and anti-gas clothing, and much of the special equipment used by that organisation, all required the assistance of the industrial sewing machine in their manufacture.

A familiar sight during the War, particularly over large cities and other places vulnerable to attack from the air, was the Balloon Barrage, and in a slightly different form this method of defence was used in the latter stages of the War against low level bombing of convoys at sea. Millions of people derived a feeling of comfort from the sight of this protective "umbrella" but how many realised that without the sewing machine it would have been impossible to produce these balloons in the quantities required ?

BARRAGE BALLOON WORK

This also applied to the making of the No. 1 life saver, the Parachute or Airchute, which in addition to saving many thousands of lives enabled the Allied Forces to drop large bodies of men into enemy-held territory at desired points to harry and destroy prepared defences and thus pave the way for the attack by ground forces whose loss of life would otherwise have been much greater. Here again without the Airchute, Arms and Food could not have been supplied to those Resistance Groups which operated in most European countries throughout the German occupation.

The collapsible rubber dinghy which was part of the life saving equipment of the air crews of R.A.F. and U.S. Air Forces, and which saved thousands of airmen who had to bale out over the sea, was also largely made on the industrial sewing machine, which obviously contributed to a great extent in the preparation of defences and in the efficiency of life saving equipment.

The sewing machine played just as important a part in the making of equipment more particularly designed for offensive action. Almost without exception every garment worn by the soldier, sailor or airman, together with the bulk of his equipment, bedding, etc., required the sewing machine for its manufacture. Tents of every kind, gun and vehicle covers, transportable hangars for aircraft, special carriers for machine guns, and countless other forms of equipment, some designed for use in the snows of Russia, others in the swamps of Burma, or in the sun and desert

of Africa, were readily made available through the use of industrial sewing machines in their various forms.

It was sometimes necessary to make modifications in certain machines in order to accomplish the desired results, and in other instances special appliances or fittings had to be made, but minor problems of this nature were speedily overcome. Deliveries of essential munitions in various forms—food, clothing or equipment, had to be made with the least possible delay and in helping to make it possible to have prompt supplies at the right place, at the right time, the industrial sewing machine played a vitally important part.

The Board of Trade originally sanctioned the issue of Certificates for materials to manufacture 800 Industrial Machines each week. This arrangement was followed by a decision to stop the supply of new Industrial Sewing Machines to the Home Market where second hand or alternative machines were available. This caused a large turnover of second hand machines to the exclusion of Singer products, but at the same time created substantial demands for the supply of repair parts for overhauling these old machines.

SEWING MACHINE PARTS AND NEEDLES

During the whole of the war period the demand for needles and replacement parts for sewing machines was unprecedented and special parts for parachute work which had been previously

imported for high speed machines had to be specially manufactured. Had the abnormal demand for needles and parts not been met promptly many sewing machines would have become idle and the production of clothing and equipment for the various Services seriously curtailed.

The Company normally make several hundred different kinds of sewing machine needles, divided into classes, varieties, sizes and styles of point, suitable for use on the finest fabric to the coarsest material and leather. Many new needles had, however, to be manufactured from special materials for certain sewing operations, such as gas masks with air tight seams, and powder and cordite bags. A record weekly production of 3,100,000 needles was attained in June 1940, necessitating the use of 50 miles of wire.

While both sexes within specified ages were being called up for the services, irrespective of the munition contracts on which they were employed, the Needle-making female staff was ultimately exempted. The Ministry of Labour was not empowered to direct females to the Needle Department from other establishments, but female labour becoming redundant from completed contracts within the Factory was exempted from the services if employment was accepted in the Needle-making Department.

During the year 1943 the demand greatly exceeded production and a licence was obtained to import 16,000,000 needles

SOME OF THE MANY STYLES OF POINT IN WHICH SINGER NEEDLES ARE MADE. THE ILLUSTRATIONS ARE GREATLY ENLARGED AND BELOW EACH IS SHOWN THE SHAPE OF PUNCTURE MADE IN THE MATERIAL.

ROUND POINT

TWIST POINT

SPEAR POINT

WEDGE POINT

CROSS POINT

STAY POINT

TRIANGULAR POINT

DIAMOND POINT

from Elizabethport to augment depleted stocks. In the same year the Ministry of Supply requested the training of additional personnel in Needle-making in view of the possibility of disposing part of the Needle-making plant and trained personnel to another part of the country. Fortunately this action was unneccessary, but the Government's interest and recommendations in this direction clearly indicated the importance placed by them on sewing machine needles and, of course, the sewing machines on which the needles are used.

AIR RAID PRECAUTIONS

THE HOME GUARD

This was a military organisation, formed when Britain was threatened with invasion, its function being to repel or delay any landing until the military authorities took over. Trained in military technique and in the use of the Rifle, Bayonet, Sten Gun, Lewis Gun and Trench Mortar, its duties included the protection of the workers and the Company's property.

The Singer Unit was formed on 14th August 1940 and by the following December had a personnel of 667. It was known as "C" Company, 2nd Battalion (H.G.) Dumbartonshire, Argyll and Sutherland Highlanders. Training was done in the employees' time, most of the major exercises being carried out on Sundays. A Guard Room was provided and a rota drawn up for mounting guard each night and during week-ends.

ENEMY AIR ACTIVITY

The first bomb to fall on the mainland of Great Britain was near Wick, in Scotland, on the night of April 10th, 1940. The first industrial town to be attacked was Middlesbrough, on the North-East Coast of England, on May 24th, 1940. Plough land in the London area was hit on 18th June 1940, the night after the surrender of France. The German Air Force followed this up by sending night bombers over Britain and by July 1940 there were also numerous attacks by daylight.

On 8th August 1940, the Battle of Britain started over the waters of the English Channel. By 10th August, it was being fought over the South of England, with attacks on ærodromes, ports and aircraft factories, and sallies towards London, which culminated on 7th September 1940.

FIRE WATCHING

Widespread and indiscriminate bombing, by High Explosive and Incendiary Fire Bombs, of dwelling houses, public buildings

and factories, made it imperative that Business Premises should be protected by watchers, and towards the end of 1940, the Government requested that Fire Watching of all Business Premises be adopted.

An appeal was immediately made to the Company's adult male employees for volunteers for this duty, and some 2,000 responded.

Watching Posts, with sleeping accommodation, were speedily erected at twelve vulnerable points in the Factory, and an organised system of fire watching was put into operation on 29th January 1941. Approximately 150 Fire Watchers were on duty every night and during week-ends, each Watcher having one all-night shift during each two-weekly period.

Training included the handling of fire fighting equipment and an intimate knowledge of the nature and location of all items of equipment within the buildings under the Watchers' patrol. Each watching post was in telephonic communication with the Main Works Fire Station, and in the event of bomb damage a personal messenger service was provided to ensure prompt reports of incidents as they occurred.

As is well known, the Battle of Britain ended with victory to the Royal Air Force and, with British mastery in the air established, the enemy ceased to use big bombers by day and switched a proportion of his attack from London to night bombing of the provinces.

During the winter months of 1940-1941, enemy bombers ranged further and further afield over industrial towns engaged in Arms production.

THE STORY OF THE CLYDEBANK BLITZ

The story of the Singer Plant at Clydebank during the war years would not be complete without reference to the severe ordeal from enemy ærial attack experienced during the nights of March 13th and 14th, 1941.

March 13th was a perfect moonlight night, and between 8 and 9 p.m., the Air Raid Siren gave the first warning of heavy concentrations of German Bombers over the Clyde, and Clydebank in particular. On that first night both High Explosive and Incendiary Bombs were employed.

The incendiaries came down like hailstones and the fires thus started, fed with more incendiaries and stoked with High Explosives, spread and raged with tremendous fierceness. Indicative of the intensity of the Incendiary Bombs is the fact that the Bowling Green in the Singer Recreation Grounds required some sixty patches of turf to restore its playing surface.

With the first warning of the Air Raid Siren the Works Fire Brigade, trained in fire fighting, was immediately on the scene, and within half an hour was busily occupied with widely dispersed fires.

By this time extensive fires had started in the Cyclone Plant, West of Cabinet Department, Iron Foundry and Combles Building housing Works Maintenance Department, Small Motor Department, Manufacturing Trade Department and Counting House, all of which were extinguished. In the case of the Small Motor Department and Sub-Counting House, however, further concentrations of Incendiary Bombs showered down and started fires which proved unmanageable. The Fire Watching party responsible for the Printing Department was able to subdue Incendiary Bombs which had penetrated the building, and thus saved it from destruction.

Successive waves of Bombers came over with clock-like regularity, and poured Incendiary and High Explosive Bombs on the neighbourhood and within the Works premises until the whole area was ablaze. Pattern Shops, Gas Plant, Wood Drying Kilns and Wood Stack Yards all blazed furiously and were totally destroyed before midnight, as were also the Veneer Store, Saw Mill, General Parts Store, Shipping Department, Machine Storage Buildings and main Counting House. The Foundry, Rumbling and Dressing Shops were seriously damaged and the

Oil Store and Cabinet Store Rooms received direct hits from High Explosive Bombs, but, fortunately, no fires resulted there.

Electric power cables and water mains were ruptured, the latter increasing the difficulties in the vain struggle of keeping the countless fires under control.

It was not until 7 a.m. on the following day that the "All Clear" or "Raiders Past" siren was sounded, and the tired limbs of Firemen and Watchers were able to relax, and Stock could be taken of the damage suffered.

Considerable numbers of workers of both sexes were on nightshift and those not required for A.R.P. duties were accommodated in their appointed Air Raid Shelters. No casualties were sustained within the premises during that long night, but the Company and its workers were to mourn the loss of 39 of the personnel who lived in the vicinity.

Despite the difficulties of transport and approach next morning, large numbers of workers, male and female, began to pour into the Factory. Stunned at first at the sight of such destruction they readily responded and were soon busily engaged in clearing glass and debris from the neighbourhood of their machines and work benches.

Mobile Kitchens sent in from adjoining districts dispensed hot drinks and sandwiches.

More and more Fire Fighters equipped with Mobile Fire

Pumps, made their appearance from neighbouring authorities and the grim business of holding the fires in check went on.

Friday is the regular pay day at Singer Factory and while the Wages Room was not seriously affected there was now no means of access to it. That the pay roll and pay tickets were safe was the result of foresight in the erection of block-houses inside Combles Building. These were composed of brick walls 9 inches thick, with cement floor and roof, and a sliding door built of 1½" square battens lined with hermetically sealed light steel sheeting. Pay rolls and pay tickets had been placed in one such block house on the previous night and were thus saved from within the still smouldering building. Accommodation had to be quickly found for making up the wages, and payment to employees was made in the afternoon with the wages boards arranged on the ground in front of the destroyed office building.

The main body of workers dispersed to find what temporary accommodation they might, for few homes in Clydebank escaped damage or destruction on the preceding night. The Fire Fighters and Watchers remained at their posts and made such preparations as were possible to meet further eventualities.

Not for long were they left in suspense for before 9 p.m. the siren sent out its wailing note and again the grim battle was on.

Once more the ground was strewn with the flaming dots of

Incendiary Bombs and High Explosive Bomb Bursts occurred at all too frequent intervals.

Soon the Forge Department was alight, and after a dour struggle the fire was contained. The Cabinet Lumber Preparation building was destroyed, as was also the Recreation Hall, (the centre and pride of the Factory Recreational and Social Activities). Many scattered fires were overcome in the remaining portion of Combles Building housing the Bakelite Department, Spare Machinery Stores, and the small remainder of Sewing Machine stocks.

On this night, too, many more of the dwellings of the Company's workers were destroyed either by fire or blast. Among countless incidents of the spirit displayed it is worthy of mention that one Fire Watcher, during a short respite, requested leave from his immediate task of Fire Fighting to find out what had happened to his own home as considerable fire was seen in that neighbourhood. Reporting back shortly afterwards and asked as to its fate he laconically replied, "It's gone," and promptly resumed the job in hand.

The "All Clear" came rather earlier on this second visit, namely, soon after 2 a.m.

About half of the Works Canteen with its cooking arrangements was destroyed. Drinking water on tap was not available, but supplies in wooden casks were brought in on Motor Trucks

by kindly business neighbours and also in Road Water Carts belonging to the local municipal authority. Then rapidly followed Army Field Kitchens which made it possible for the Singer Canteen staff, assisted by willing hands, to dispense welcome hot soup, and this, in conjunction with the Mobile Kitchens, bridged the gap until normal facilities were restored and regular cooked meals available once more.

Time was forgotten by technicians in assessing the damage and planning the progressive restoration of power services to permit of the earliest resumption, and day and night electricians were to be seen in trenches mending and replacing broken power cables. Water mains were uncovered, ruptures located and water made available, but only for sanitary purposes owing to extensive damage to the public water mains feeding the town and factory.

Everywhere was orderly bustle. Broken and twisted machinery was cleared to enable work to be resumed ; blown out windows were patched with sheets of corrugated iron, cardboard or anything suitable, and partial resumption was made on Monday, March 17th, although fires were still burning in some parts of the Plant.

On that evening nightshift work was resumed on such war work as was possible, and thenceforward more and more workers returned to their appointed jobs, despite the fact that

many who had lost their homes, indeed everything except what they actually stood up in, were spending two to three hours daily in travelling from and to their temporary homes.

Gaping roofs were sheeted in many cases with tarpaulins and made as weathertight as possible. In less than six weeks pre-blitz production had been re-established, but some 390,000 sq. ft. of floor space had been wiped out.

The Clyde area was revisited in strength by enemy bombers some seven weeks later but, fortunately, the immediate neighbourhood of the Factory escaped serious attention.

Frequent air raid warnings were received, however, and so as not to impede production by unduly long stoppages, the Factory A.R.P. Control Room, in common with other plants in the neighbourhood, received messages from Area Control which enabled work to be carried on until the raiders were within such distance as to indicate that bombing was imminent. Then, and then only, was the order given to evacuate the working personnel to their appointed Air Raid Shelters.

As a large number of employees were now residing at considerable distance from the Works, it was difficult to fully man the Factory Fire Watching Posts. Outside authorities were also recruiting for the Fire Watching of all public buildings and various other air raid precaution duties. Towards the end of 1941, the required number of voluntary Fire Watchers could not

be obtained and the position was intimated to the appropriate Government Department. The necessary authority to introduce a compulsory scheme of Fire Watching was issued under Fire Prevention (Business Premises) No. 2 Order, 1941. This Order made it obligatory on all male employees between 18 and 65 to take their rota of Fire Watching on the premises where they were employed. By so doing, they were exempted or partly exempted from A.R.P. duties under local or other authorities.

The events of those two fateful nights have been dealt with at some length, not because the experience was unique, indeed it was a common one in many industrial centres in Great Britain, but to present a factual picture of Singer Factory experiences during World War II, and to enable readers to visualise the many handicaps to be overcome before normal production could be resumed.

RECONSTRUCTION

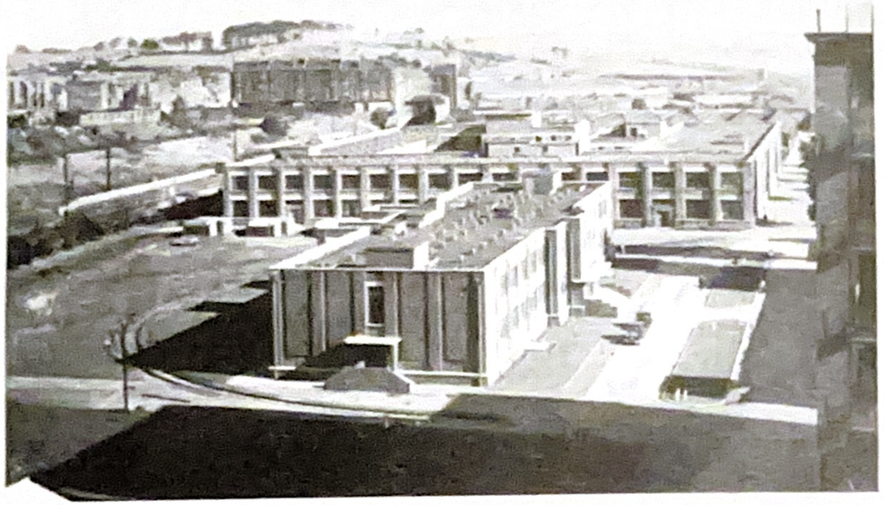
Following the grievous loss by enemy action of plant and manufacturing and storage floor space it was apparent that, apart from the work of First Aid repairing which went on unremittingly and as rapidly as the restricted facilities during hostilities permitted, a programme of Reconstruction of the totally destroyed buildings was imperative.

Plans were drawn up, therefore, and submitted for approval to the appropriate Government Departments and ultimately permission was granted to proceed on a modified scale.

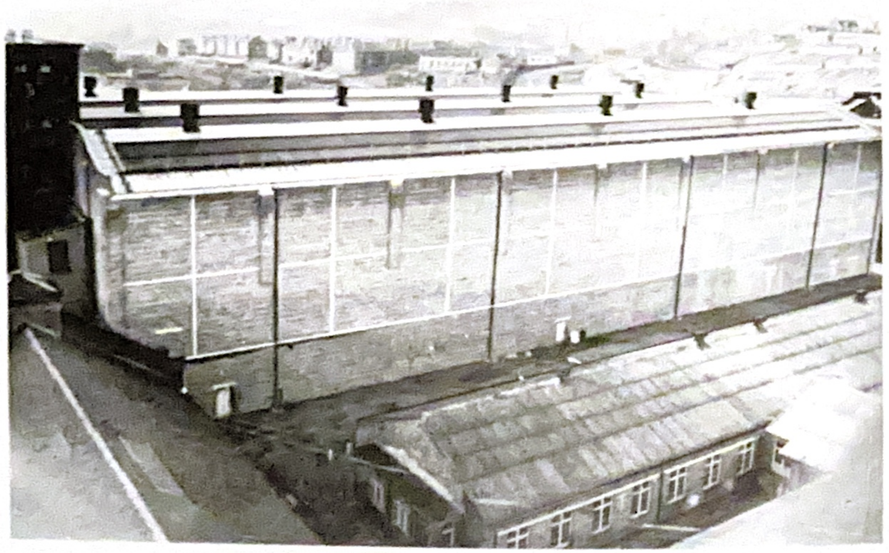
Thus it was that the Counting House Staff was able to function in a permanent new office building after being housed in various locations, including the old burned-out offices over which a sheet iron roof had been erected.

The Small Motor Department, whose premises and equipment had been almost totally destroyed, found restricted accommodation in the Cabinet Department and later in the Stand Department building where they handled a small output of Transmitter Motors in addition to numerous war contracts, were also re-established in new permanent premises.

A portion of the Shipping Department designed to carry a certain amount of storage to bridge that period until authority was granted to rebuild the Crane Bay Storage also formed part of this interim plan, together with a small portion of the destroyed lumber preparation plant.



COUNTING HOUSE AND ELECTRICAL DEPARTMENTS



VENEER AND DIMENSION WOOD STORE

In this latter portion it was intended to carry through the Lancaster Bomber project, but such were the uncertainties of those times that the buildings were taken over by the Food Storage Authority and retained until January 1945.

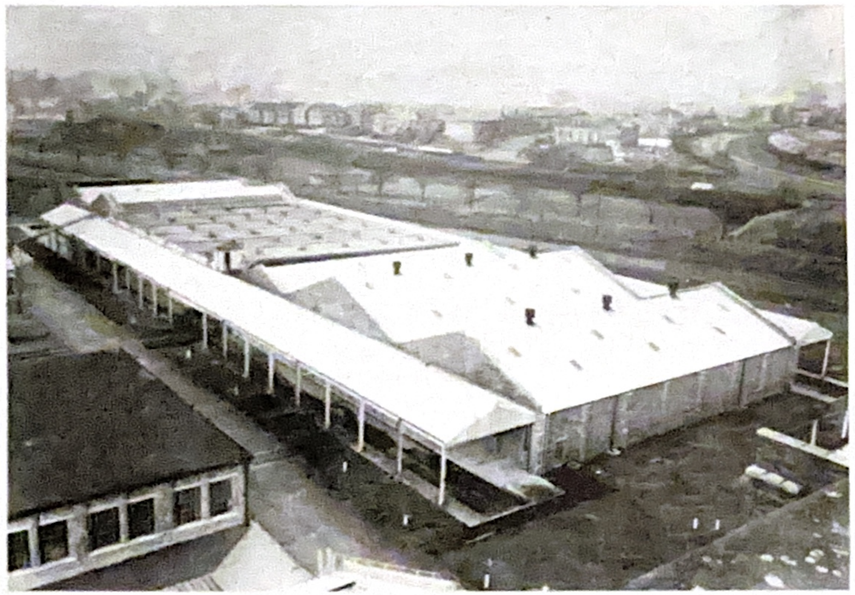
As the tempo of Ministry Contracts slackened and the end of the war approached, it became increasingly necessary to rehabilitate the remaining blitzed buildings, for which licences were obtained to enable construction operations to commence.

Careful review was made of the new equipment required to replace that destroyed by blitz action, and, in short, every step was taken to press forward with all speed to provide once again full facilities for normal production.

As each successive war contract was cancelled such plant as had been converted was modified and overhauled to fit it for its normal work.

Personnel which had come to the Company during the period of hostilities, was now required for normal Singer peace time production, and, while the Company still retained a number of employees with pre-war experience of Singer products, it was also true that the war years had taken a very heavy toll of men and women who had joined the Forces or who had obtained other employment. This experience was, of course, by no means unique, but it required loyal help from all whose training fitted them to play their part in reorganising for peace.

SEWING MACHINE STORAGE
AND SHIPPING DEPARTMENTS



DRYING KILNS
AND NORMALISING ROOMS

CASE AND CRATE MILL
AND HARDWOOD LUMBER MILL

As was only to be expected, the normal products of The Singer Manufacturing Company Ltd. have been inadequate to satisfy the public demand over a considerable period. Production is, of course, dependent on the availability of supplies of raw materials, such as steel and timber, but a very encouraging start has been made and despite the difficulties mentioned, continuous and steady improvement is being achieved in an effort to meet once again the insistent demand for Singer products.